[redacted]

DUP

MonN-267
Cy-5A

Contract No. W-35-058-eng-71

####

OPERATING DEPARTMENT

Report for Month Ending February 28, 1947

F. R. Stuckey, E. J. Witkowski and L. B. Emlet

####

Date Received: 3/11/47 Date Issued: 3/11/47

[redacted]

~~SECRET~~

SUMMARY

1. Two slugs with ruptured jackets were located and discharged from the pile. This difficulty caused contamination of the cooling air exhaust fans.

2. The pile contains about 145 inhours excess reactivity.

3. Barium run 15-A was completed March 5, 1947, and 1900 curies shipped. The product was within specifications in all respects.

4. Approximately 100 mc of S^{35} has been separated from bombarded KCl by the Technical Division for distribution to radioactive isotope customers. This is the first separated S^{35} prepared at Clinton Laboratories for distribution.

5. A total of 104 isotope shipments were made during the month to bring the total to 482 shipments since August, 1946, the starting date of the isotope distribution program.

~~SECRET~~

A. 100 AREA OPERATION

I. Operating Data:

Total accumulated KWH for month	2,406,071
Average KW/operating hour	3805.99
Average KW/24-hour day	3580.46
Percent lost time	5.9%
Approx. excess pile reactivity	145 inhours
Slugs charged	669
Slugs discharged	681
Product made	87.82 grams
Product discharged	24.03 grams

II. Pile Operations:

The pile operation was interrupted on two occasions to locate and discharge slugs with ruptured jackets. On February 4, 1947, a broken slug was found in Hole 1576 and again on February 6, 1947, a leaking slug was located in Channel 1366. These slugs had been exposed for 850 days and 319 days, respectively. In addition, the pile was shut down as scheduled for the removal and insertion of samples, discharge of 592 slugs for the 706-D operation (isolation of Ba^{140}), discharge of 130 $Ca(NO_3)_2$ slugs for the isolation of C^{14} and other miscellaneous work.

The excess pile reactivity decreased from 155 inhours to 145 inhours. This decrease is attributed to the loading of additional water samples in Hole 12.

III. Fan Operation:

The two ruptured slugs have caused contamination of the fans. Number 2 fan is reading about 1250 mr/hr and Number 3 fan about 5000 mr/hr on contact with the housing.

IV. Radioisotopes:

A total of seventy-seven (77) standard exposure cans were loaded to the pile for neutron bombardment. As of February 28, 1947, there were 106 cans in the pile, of which about 50% were for the radioisotope program.

V. Miscellaneous:

1. Slug Testing

To date 32,387 slugs have been tested. Rejects have averaged 1.3%. The increase in the number of rejects is attributed to the testing of Class 2 slugs. Class 2 slugs include the uranium which appeared to be porous and probably contain small quantities of moisture. The slug testing program will be completed during March, 1947.

2. Thorium Carbonate Pellets

Four hundred pellets, each containing 80 gms of thorium carbonate were pressed for the Chemistry Division.

3. Experimental Facilities

A project is being prepared for submission to the AEC for improvement of the experimental facilities on the north side of the pile. The project proposes that two of the four shim rods be removed to make available two additional experimental holes and that the existing platforms be extended and relocated to make all holes more accessible.

B. 706-D AREA

I. Barium (Ba^{140} - 12.5d) - Run 15-A:

Cell B was decontaminated and equipment repairs made during the early part of the month. Some of the Tygon tubing within Cell B was replaced with either Hastalloy C or stainless steel pipe. The electrolytic cell (B-12) was dismantled and the insulators replaced. Three platinum wire leads were placed on the platinum wire gauze to facilitate the installation of a three-wire electrical system.

Run 15-A was started on February 26, 1947, and proceeded with no difficulty. Shipment of the 1900 curies isolated was made on March 5, 1947. The product was within specifications in all respects. The analysis follows:

	Batch 15-A	Specifications
Lead	4 mg	Less than 50 mg
Chromium	2 mg	Less than 5 mg
Nickel	4 mg	Less than 5 mg
Iron	0.8 mg	Less than 10 mg
Sr	1.6 mg	Less than 10 mg
Ba	290 mg	Less than 1000 mg

II. Radioisotopes:

1. Iodine (I^{131} - 8d)

Twenty-one runs were made this month, yielding a total of 1300 mc. Four of these runs were below average in recovery. No reason has been found for this result.

One shipment was held up for three days due to high Te activity in the product. In order to eliminate this condition before starting a new series of runs, the equipment was decontaminated. Experience now indicates that the equipment can operate successfully for approximately forty runs but to have a factor of safety, it will be decontaminated after each twenty-five runs.

The tantalum-lined dissolvers have arrived on the plant and preliminary work before installation in 706-C has started.

2. Phosphorus (P^{32} - 14.3d)

Three runs were made this month. The recovery of P^{32} is improving. In order to improve the purity of the product, the resin was changed from IR-1 to "Nalcite". It was thought that a small amount of organic material is extracted from the resin. The whole problem of the purity of the P^{32} product is being discussed with the Chemistry Division.

The new equipment in Cell 5 of 205 Building is being tested by the Technical Division. Dummy runs are being made in order to determine the optimum operating conditions. A number of leaks have developed which will be repaired. No date has been set as to when this equipment will be ready for operation.

3. Carbon (C^{14} - 6100y)

One run of twenty hot slugs was made by the Technical Division. Approximately 10 microcuries were recovered. During this run a number of leaks in the equipment were found. Repairs will be made before further testing.

4. Praeseodymium (Pr^{143} - 13.8d)

Three samples of CeO_2 were removed from the pile and processing started. Fourteen (14) mc of Pr^{143} were present in the starting solution. Due to the length of the procedure not more than 30% of this can be recovered.

5. Sulfur (S^{35} - 88d)

One shipment of S^{35} was made from material prepared by the Technical Division. One hundred (100) mc were on hand at the middle of the month. It was isolated as H_2SO_4; about half of it was carrier-free.

Due to the low energy β ray given off by S^{35}, it must be assayed on a low absorption counter. All shipments will be made on the activity value at zero absorber.

6. Ruthenium ($Ru^{103-106}$ - 42d-1y)

Development work on the recovery of $Ru^{103-106}$ is planned by the Technical Division. Equipment has been installed on the third floor of the 706-D Building, but due to other work no progress has been made during the past month.

7. Fission Products

Most of the fission products shipped this month were supplied by the Chemistry Division (Bldg. 706-C). The production of fission products is being delayed until the tantalum-lined dissolver is installed.

8. Calcium (Ca^{45} - 180d)

The Technical Division is doing development work on organic aqueous phase separation of active Ca^{45} from Sc.

III. Tank Farms and Burial Ground:

1. Tank Farm

The following listings indicate the movement of solutions in the Tank Farm for the month of February:

WATER WASTES

Tanks	Capacity	Est. Amt. Rec'd-Feb.	Disposed Of	Discharged To	Free Space
W-1 & 2	8,800 gal.	127,000 gal.	127,000 gal.	Settling Basin	8,800 gal.

The larger portion of this water waste came from the 115 Building fan seals and approximately 10% came from Cell 5 operation in 205 Building.

CHEMICAL WASTES

W-5 & 6	340,000 gal.	216,200 gal.	238,000 gal.	Settling Basin	138,600 gal.

Approximately 90% of this waste was received from the 706-D operation (decontamination waste). About fifteen (15) gallons of thorium waste solution received from Chicago was disposed of in the chemical waste system.

METAL WASTE

W-3-4-7-8-9-10	754,400 gal.	2,200 gal.	35,000 gal.	Settling Basin	107,700 gal.

Approximately 6,600 gallons of 50% liquid caustic was added to the metal waste tanks during the month of February to precipitate the uranium metal. About 35,000 gallons of clear supernate was decanted off to the Settling Basin. 18,200 gallons contained 0.01% uranium and 16,800 gallons contained 0.005% uranium. Approximately 45 gallons metal waste was received from Chicago, disposed of in W-4 metal waste tank.

SETTLING BASIN

Total Est. Discharge	Total Curies Discharged	β counts/min/ml Average	High	Low	Discharged To
26,116,000 gal.	127	398	987	99	White Oak Creek

RETENTION PONDS

225,000 gal.	0.04	15	44	5	White Oak Creek

S E C R E T

2. Burial Ground

(a) Special Burials

Date	Item	From	Remarks
2/6/47	10-35 gal. drums and 1-1000# box of contaminated material.	Dayton	This load read about 180 mr/hr before burying. It was buried under two feet of concrete and about seven feet of dirt.
2/6/47	9-55 gal. drums of hexone waste.	Chicago	This load read about 50 mr/hr before burying. It was disposed of in the β and γ trench.
2/6/47	2-55 gal. drums of hexone waste.	Semi-works	This load read about 40 mr/hr before burying. It was disposed of in the β and γ trench.
2/14/47	30-35 gal. drums and 2-500# boxes of contaminated material (alpha emitting).	Dayton	Alpha disintegration measured about 60,000 d/min. Buried under two feet of concrete and and six feet of dirt.
2/14/47	1 - hot sink	105 Bldg.	This sink redd about 200 mr/hr before burying. Buried under two feet of concrete and six feet of dirt.
2/24/47	30-35 gal. drums and 2-500# boxes of alpha emitting material and 3-25# paper wrapped packages of contaminated metal.	Dayton	Alpha disintegration measured greater than 60,000 d/min. Buried under two feet of concrete and six feet of dirt.

(b) Routine Burials

Due to the conversion of Cells 1, 2, and 3 of the 205 Building to the Hot Pilot Plant, a considerable amount of material was hauled to the Burial Ground for storage or disposal. In addition, about 250 cans full of contaminated trash were buried along with other miscellaneous items.

C. RADIOISOTOPE PRODUCTION AND SHIPMENTS

I. General:

1. Record of Shipments

The following table indicates the monthly breakdown of radioisotope shipments since August, 1946, the start of the distribution program.

	1946					1947		
	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	TOTAL
Separated Material 706-D Area	16	24	35	44	60	63	64	306
Unseparated Material 100 Area	5	16	20	26	33	36	40	176
TOTAL	21	40	55	70	93	99	104	482

2. Shipping Containers

In an attempt to ship the maximum amount of activity with the existing lead shields and still remain within the limit of 15 mr/hr at the surface of the package, shipping boxes with dimensions 21" x 21" x 25½" are being fabricated. These new containers should allow us to handle about three times the present quantities of gamma activity.

3. Isotope Prices

A new price list for the various isotopes will be effective March 1, 1947. This change will also revise the method of costing for the 100 Area charges.

4. Decontamination of Shipping Containers

Many of the containers returned to Clinton Laboratories require decontamination before they can be reused. In some cases the contamination is the result of difficulty in opening the aluminum exposure can. Several procedures are being investigated in an attempt to eliminate this trouble. All cutters in the containers are being tested prior to shipment. In cases where the target material almost fills the can, it is being wrapped in aluminum foil before exposure in the pile. The results of this study will be reported later.

II. Production and Shipment Summary:

1. Table I - Production and Distribution of Isotopes for February, 1947.

2. Table II - Outstanding Orders as of February 28, 1947.

3. Table III - Summary of Shipments for each Isotope, August through February.

UNSEPARATED MATERIALS

Isotope	Na^{24}	P^{32}	P^{32}	K^{42}	Ca^{45}	Ca^{41-45}	$Fe^{55,59}$	Co^{60}*	Cu^{64}	As^{76}	Br^{82}	Rb^{86}	Mo^{99}	I^{131}	$Ce^{141-143}$	W^{185}	Ir^{192}	Au^{198}	Tl^{206}
Target Material	Na_2CO_3	S	KH_2PO_4	K_2CO_3	Sc_2O_3	$CaCO_3$	Fe	Co_3O_4	Cu	As_2O_3	KBr	Rb_2CO_3	Mo_2O_3	Te	CeO_2	Na_2WO_4	IrO_2	Au	$Tl(NO_3)_2$
Grams	0.9	2000	31	22	.002	31	17	0.9	.32	.06	0.9	6.5	10	50	0.83	9.0	.22	.016	10
Inventory 1/31/47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Produced	2	4	9	3	5	13	5	4*	1	1	1	1	1	22	3	1	1	9	1
Inventory 2/28/47	1	0	1	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
To Account For	1	4	8	3	0	13	5	4*	1	1	1	1	1	22	3	1	1	9	1
Disposition:																			
Shipped	1	0	7	3	0	13	5	4*	1	1	1	1	1	0	0	1	1	9	1
Project	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
706-D	0	4	0	0	0	0	0	0	0	0	0	0	0	22	3	0	0	0	0
Buried	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Opr. Dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	4	8	3	0	13	5	4*	1	1	1	1	1	22	3	1	1	9	1

* 8.5g per unit - Special irradiation for National Bureau of Standards to furnish 1c of Co^{60}.

SECRET

	FISSION PRODUCTS		SEPARATED MATERIALS				
Isotope	$Element^{43}$	Ba^{140}	CaF_3** ($CaBF_3$)	C^{14}	P^{32}	S^{35}	I^{131}
Inventory 1/31/47	-	-	-	124.81 mc	-	-	-
Produced	109 ugm	1.04 mc	-	-	1449.8 mc	5 mc	1054.3 mc
*Received	-	-	83,500 gm	-	-	-	-
Inventory 2/28/47	-	-	83,379.594gm	116.81 mc	-	-	-
To Account For	109 ugm	1.04 mc	120.406gm	8.0 mc	1449.8 mc	5 mc	1054.3 mc
Disposition:							
Shipped-Isotope	-	-	-	7.0 mc	1269.8 mc	-	1018.3 mc
Shipped-Project	-	-	-	1.0 mc	160.0 mc	5 mc	36.0 mc
-Intraplant	-	1.04 mc	120.406gm	-	20.0 mc	-	-
TOTAL -	109 ugm	1.04 mc	120.406gm	8.0 mc	49.8 mc	5 mc	1054.3 mc
* Material received from Area Engineer. ** Complex of Calcium, Boron and Fluorine containing enriched B^{10}.	1 Shipment	1 Intraplant Transfer	1 Intraplant Transfer	7 Shipments	28 Shipments 1 Intraplant Transfer	1 Shipment	27 Shipments

SECRET

TABLE II

OUTSTANDING ORDERS -2/28/47

Fission Products	Amount (mc)	No. of Shipments
Ba^{140}	20 mc	2
$Ru^{103-106}$-$Te^{127-129}$	5 mc	1
$Ce^{141-144}$	15 mc	2
Pr^{143}, Nd^{147}, Eu^{156}, etc.	10 mc	1
Zr^{95}	425 mc	3
Sr^{89-90}	205 mc	3
$Element^{61}$	2 mc	2
Cs^{137}	5 mc	1
Zr^{95} - Cb^{95}	100 mc	1
TOTAL	787 mc	16

Separated Materials		
P^{32}	2879 mc	64
Ca^{45}	.01 mc	1
I^{131}	1445 mc	43
S^{35}	5 mc	1
TOTAL	4329.01 mc	109

TABLE II

OUTSTANDING ORDERS -2/28/47

Unseparated Materials	Amount (Units)	No. of Shipments
Na^{24}	35	35
P^{32} (S)	5	5
P^{32}	21	21
S^{35}	2	2
Cl^{36}	1	1
K^{42}	9	9
Ca^{45}	3	3
Fe^{55-59}	7	7
Co^{60}	3	3
Cu^{64}	3	3
Zn^{65-69}	1	1
Ga^{72}	1	1
Br^{82}	1	1
$Ag^{108-110}$	1	1
I^{131}	2	2
Au^{198}	36	36
Tl^{206}	2	2
TOTAL	126	126

SUMMARY	No. Orders Outstanding
Fission Products	126
Separated Materials	109
Unseparated Materials	16
GRAND TOTAL	251

ISOTOPE SHIPMENT SUMMARY

MATERIAL	SHIPMENTS AUG. THRU JAN.		SHIPMENTS FEBRUARY		TOTAL TO DATE	
	Amount - mc	No. Shipments	Amount - mc	No. Shipments	Amount - mc	No. Shipments
Fission Products:						
Sr^{89-90}	1549.0	8	-	-	1549.0	8
Y^{91}	274.0	3	-	-	274.0	3
$Ru^{103-106}-Te^{127-129}$	10.0	1	-	-	10.0	1
$Ru^{103-106}$	2.0	1	-	-	2.0	1
Cs^{137}	2.0	2	-	-	2.0	2
Ba^{140}	90.0	3	-	-	90.0	3
$Ce^{141-144}$	10.0	1	-	-	10.0	1
61^{147}	50.0	1	-	-	50.0	1
61^{149}	0.45	2	-	-	0.45	2
$Element^{43}$	-	-	109 ugm	1	109 ugm	1
TOTAL	1987.45	22	109 ugm	1	1987.45	25
Separated:						
C^{14}	70.05	56	8	7	78.05	63
I^{131}	3053.7	100	1054.3	27	4108.0	127
P^{32}	3450.2	63	1429.8	28	4880.0	91
S^{35}	-	-	5.0	1	5.0	1
Pr^{143}	0.74	1	-	-	0.74	1
TOTAL	6574.69	220	2497.1	63	9071.79	283

SECRET

TABL[illegible] [illegible]II (Cont.)

ISOTOPE SHIPMENT SUMMARY

MATERIAL	SHIPMENTS AUG. THRU JAN.		SHIPMENTS FEBRUARY		TOTAL TO DATE	
	Amount - Units	No. Shipments	Amount-Units	No. Shipments	Amount - Units	No. Shipments
Unseparated Units:						
Na^{24}	2	2	1	1	3	3
P^{32} (S)	3	3	1	1	4	4
P^{32} (KH_2PO_4)	21	21	8	8	29	29
S^{35} (S)	2	2	0	0	2	2
S^{35} (KCl)	14	14	0	0	14	14
Cl^{36}	2	2	0	0	2	2
Ca^{41-45}	5	5	13	4	18	9
K^{42} (K_2CO_3)	9	9	3	3	12	12
K^{42} (KCl)	1	1	0	0	1	1
Sc^{46}	2	2	0	0	2	2
Fe^{55-59}	9	9	5	5	14	14
Ni^{59}	1	1	0	0	1	1
Co^{60}	6	6	4*	1	10	7
Cu^{64}	3	3	1	1	4	4
Zn^{65-69}	2	2	0	0	2	2
As^{76}	1	1	1	1	2	2
Br^{82}	2	2	1	1	3	3
Rb^{86}	0	0	1	1	1	1
Mo^{99}	0	0	1	1	1	1
Ag^{110}	2	2	0	0	2	2
$Sb^{122-124}$	2	2	0	0	2	2
I^{131}	5	5	0	0	5	5
Ba^{131}	1	1	0	0	1	1
Cs^{134}	5	5	0	0	5	5
Ta^{182}	1	1	0	0	1	1
W^{185}	0	0	1	1	1	1
Ir^{192}	0	0	1	1	1	1
Hg^{197}	1	1	0	0	1	1
Au^{198}	30	30	9	9	39	39
Tl^{206}	1	1	1	1	2	2
Special Irradiations	3	3	0	0	3	3
TOTAL	136	136	52	40	188	176

* Special 8.5 grams per unit

SECRET

TABLE III (Cont.)

ISOTOPE SHIPMENT SUMMARY

MATERIAL	SHIPMENTS AUG. THRU JAN.		SHIPMENTS FEBRUARY		TOTAL TO DATE	
	Amount - Units	No. Shipments	Amount -Units	No. Shipments	Amount - Units	No. Shipments
TOTALS:						
Fission Products		22		1		23
Separated Materials		220		63		283
Unseparated Units		136		40		176
GRAND TOTALS		378		104		482

[redacted]

[redacted]

MonN-267
Cy-5A

Contract No. W-35-058-eng-71

####

OPERATING DEPARTMENT

Report for Month Ending February 28, 1947

F. R. Stuckey, E. J. Witkowski and L. B. Emlet

####

DECLASSIFIED

Per Letter Instructions Of
TID-1160
D. McGhee
For: N. T. Bray, Supervisor
Laboratory Records Dept.
ORNL

Date Received: 3/11/47

Date Issued: 3/11/47

[redacted]

Publicly Releasable

This document has received the necessary patent and technical information reviews and can be distributed without limitation.

[redacted]

[redacted]

[redacted]

SUMMARY

1. Two slugs with ruptured jackets were located and discharged from the pile. This difficulty caused contamination of the cooling air exhaust fans.

2. The pile contains about 145 inhours excess reactivity.

3. Barium run 15-A was completed March 5, 1947, and 1900 curies shipped. The product was within specifications in all respects.

4. Approximately 100 mc of S^{35} has been separated from bombarded KCl by the Technical Division for distribution to radioactive isotope customers. This is the first separated S^{35} prepared at Clinton Laboratories for distribution.

5. A total of 104 isotope shipments were made during the month to bring the total to 482 shipments since August, 1946, the starting date of the isotope distribution program.

[redacted]

A. 100 AREA OPERATION

I. Operating Data:

Total accumulated KWH for month	2,406,071
Average KW/operating hour	3805.99
Average KW/24-hour day	3580.46
Percent lost time	5.9%
Approx. excess pile reactivity	145 inhours
Slugs charged	669
Slugs discharged	681
Product made	87.82 grams
Product discharged	24.03 grams

II. Pile Operations:

The pile operation was interrupted on two occasions to locate and discharge slugs with ruptured jackets. On February 4, 1947, a broken slug was found in Hole 1576 and again on February 6, 1947, a leaking slug was located in Channel 1366. These slugs had been exposed for 850 days and 319 days, respectively. In addition, the pile was shut down as scheduled for the removal and insertion of samples, discharge of 592 slugs for the 706-D operation (isolation of Ba^{140}), discharge of 130 $Ca(NO_3)_2$ slugs for the isolation of C^{14} and other miscellaneous work.

The excess pile reactivity decreased from 155 inhours to 145 inhours. This decrease is attributed to the loading of additional water samples in Hole 12.

III. Fan Operation:

The two ruptured slugs have caused contamination of the fans. Number 2 fan is reading about 1250 mr/hr and Number 3 fan about 5000 mr/hr on contact with the housing.

IV. Radioisotopes:

A total of seventy-seven (77) standard exposure cans were loaded to the pile for neutron bombardment. As of February 28, 1947, there were 106 cans in the pile, of which about 50% were for the radioisotope program.

V. Miscellaneous:

1. Slug Testing

To date 32,387 slugs have been tested. Rejects have averaged 1.3%. The increase in the number of rejects is attributed to the testing of Class 2 slugs. Class 2 slugs include the uranium which appeared to be porous and probably contain small quantities of moisture. The slug testing program will be completed during March, 1947.

2. Thorium Carbonate Pellets

Four hundred pellets, each containing 80 gms of thorium carbonate were pressed for the Chemistry Division.

3. Experimental Facilities

A project is being prepared for submission to the AEC for improvement of the experimental facilities on the north side of the pile. The project proposes that two of the four shim rods be removed to make available two additional experimental holes and that the existing platforms be extended and relocated to make all holes more accessible.

B. 706-D AREA

I. Barium (Ba^{140} - 12.5d) - Run 15-A:

Cell B was decontaminated and equipment repairs made during the early part of the month. Some of the Tygon tubing within Cell B was replaced with either Hastalloy C or stainless steel pipe. The electrolytic cell (B-12) was dismantled and the insulators replaced. Three platinum wire leads were placed on the platinum wire gauze to facilitate the installation of a three-wire electrical system.

Run 15-A was started on February 26, 1947, and proceeded with no difficulty. Shipment of the 1900 curies isolated was made on March 5, 1947. The product was within specifications in all respects. The analysis follows:

	Batch 15-A	Specifications
Lead	4 mg	Less than 50 mg
Chromium	2 mg	Less than 5 mg
Nickel	4 mg	Less than 5 mg
Iron	0.8 mg	Less than 10 mg
Sr	1.6 mg	Less than 10 mg
Ba	290 mg	Less than 1000 mg

II. Radioisotopes:

1. Iodine (I^{131} - 8d)

Twenty-one runs were made this month, yielding a total of 1300 mc. Four of these runs were below average in recovery. No reason has been found for this result.

One shipment was held up for three days due to high Te activity in the product. In order to eliminate this condition before starting a new series of runs, the equipment was decontaminated. Experience now indicates that the equipment can operate successfully for approximately forty runs but to have a factor of safety, it will be decontaminated after each twenty-five runs.

The tantalum-lined dissolvers have arrived on the plant and preliminary work before installation in 706-C has started.

2. Phosphorus (P^{32} - 14.3d)

Three runs were made this month. The recovery of P^{32} is improving. In order to improve the purity of the product, the resin was changed from IR-1 to "Nalcite". It was thought that a small amount of organic material is extracted from the resin. The whole problem of the purity of the P^{32} product is being discussed with the Chemistry Division.

The new equipment in Cell 5 of 205 Building is being tested by the Technical Division. Dummy runs are being made in order to determine the optimum operating conditions. A number of leaks have developed which will be repaired. No date has been set as to when this equipment will be ready for operation.

3. Carbon (C^{14} - 6100y)

One run of twenty hot slugs was made by the Technical Division. Approximately 10 microcuries were recovered. During this run a number of leaks in the equipment were found. Repairs will be made before further testing.

4. Praeseodymium (Pr^{143} - 13.8d)

Three samples of CeO_2 were removed from the pile and processing started. Fourteen (14) mc of Pr^{143} were present in the starting solution. Due to the length of the procedure not more than 30% of this can be recovered.

5. Sulfur (S^{35} - 88d)

One shipment of S^{35} was made from material prepared by the Technical Division. One hundred (100) mc were on hand at the middle of the month. It was isolated as H_2SO_4; about half of it was carrier-free.

Due to the low energy β ray given off by S^{35}, it must be assayed on a low absorption counter. All shipments will be made on the activity value at zero absorber.

6. Ruthenium ($Ru^{103-106}$ - 42d-1y)

Development work on the recovery of $Ru^{103-106}$ is planned by the Technical Division. Equipment has been installed on the third floor of the 706-D Building, but due to other work no progress has been made during the past month.

7. Fission Products

Most of the fission products shipped this month were supplied by the Chemistry Division (Bldg. 706-C). The production of fission products is being delayed until the tantalum-lined dissolver is installed.

8. Calcium (Ca^{45} - 180d)

The Technical Division is doing development work on organic aqueous phase separation of active Ca^{45} from Sc.

III. Tank Farms and Burial Ground:

1. Tank Farm

The following listings indicate the movement of solutions in the Tank Farm for the month of February:

WATER WASTES

Tanks	Capacity	Est. Amt. Rec'd-Feb.	Disposed Of	Discharged To	Free Space
W-1 & 2	8,800 gal.	127,000 gal.	127,000 gal.	Settling Basin	8,800 gal.

The larger portion of this water waste came from the 115 Building fan seals and approximately 10% came from Cell 5 operation in 205 Building.

CHEMICAL WASTES

W-5 & 6	340,000 gal.	216,200 gal.	238,000 gal.	Settling Basin	138,600 gal.

Approximately 90% of this waste was received from the 706-D operation (decontamination waste). About fifteen (15) gallons of thorium waste solution received from Chicago was disposed of in the chemical waste system.

METAL WASTE

W-3-4-7-8-9-10	754,400 gal.	2,200 gal.	35,000 gal.	Settling Basin	107,700 gal

Approximately 6,600 gallons of 50% liquid caustic was added to the metal waste tanks during the month of February to precipitate the uranium metal. About 35,000 gallons of clear supernate was decanted off to the Settling Basin. 18,200 gallons contained 0.01% uranium and 16,800 gallons contained 0.005% uranium. Approximately 45 gallons metal waste was received from Chicago, disposed of in W-4 metal waste tank.

SETTLING BASIN

Total Est. Discharge	Total Curies Discharged	β counts/min/ml Average	High	Low	Discharged To
26,116,000 gal.	127	398	987	99	White Oak Creek

RETENTION PONDS

225,000 gal.	0.04	15	44	3	White Oak Creek

2. Burial Ground

(a) Special Burials

Date	Item	From	Remarks
2/6/47	10-35 gal. drums and 1-1000# box of contaminated material.	Dayton	This load read about 180 mr/hr before burying. It was buried under two feet of concrete and about seven feet of dirt.
2/6/47	9-55 gal. drums of hexone waste.	Chicago	This load read about 50 mr/hr before burying. It was disposed of in the β and γ trench.
2/6/47	2-55 gal. drums of hexone waste.	Semi-works	This load read about 40 mr/hr before burying. It was disposed of in the β and γ trench.
2/14/47	30-35 gal. drums and 2-500# boxes of contaminated material (alpha emitting).	Dayton	Alpha disintegration measured about 60,000 d/min. Buried under two feet of concrete and and six feet of dirt.
2/14/47	1 - hot sink	105 Bldg.	This sink redd about 200 mr/hr before burying. Buried under two feet of concrete and six feet of dirt.
2/24/47	30-35 gal. drums and 2-500# boxes of alpha emitting material and 3-25# paper wrapped packages of contaminated metal.	Dayton	Alpha disintegration measured greater than 60,000 d/min. Buried under two feet of concrete and six feet of dirt.

(b) Routine Burials

Due to the conversion of Cells 1, 2, and 3 of the 205 Building to the Hot Pilot Plant, a considerable amount of material was hauled to the Burial Ground for storage or disposal. In addition, about 250 cans full of contaminated trash were buried along with other miscellaneous items.

C. RADIOISOTOPE PRODUCTION AND SHIPMENTS

I. General:

1. Record of Shipments

The following table indicates the monthly breakdown of radioisotope shipments since August, 1946, the start of the distribution program.

	1946					1947		
	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	TOTAL
Separated Material 706-D Area	16	24	35	44	60	63	64	306
Unseparated Material 100 Area.	5	16	20	26	33	36	40	176
TOTAL	21	40	55	70	93	99	104	482

2. Shipping Containers

In an attempt to ship the maximum amount of activity with the existing lead shields and still remain within the limit of 15 mr/hr at the surface of the package, shipping boxes with dimensions 21" x 21" x 25½" are being fabricated. These new containers should allow us to handle about three times the present quantities of gamma activity.

3. Isotope Prices

A new price list for the various isotopes will be effective March 1, 1947. This change will also revise the method of costing for the 100 Area charges.

4. Decontamination of Shipping Containers

Many of the containers returned to Clinton Laboratories require decontamination before they can be reused. In some cases the contamination is the result of difficulty in opening the aluminum exposure can. Several procedures are being investigated in an attempt to eliminate this trouble. All cutters in the containers are being tested prior to shipment. In cases where the target material almost fills the can, it is being wrapped in aluminum foil before exposure in the pile. The results of this study will be reported later.

II. Production and Shipment Summary:

1. Table I - Production and Distribution of Isotopes for February, 1947.
2. Table II - Outstanding Orders as of February 28, 1947.
3. Table III - Summary of Shipments for each Isotope, August through February.

SECRET

ISOTOPE PRODUCTION - FEBRUARY, 1947

UNSEPARATED MATERIALS

Isotope	Na^{24}	P^{32}	P^{32}	K^{42}	Ca^{45}	Ca^{41-45}	$Fe^{55,59}$	Co^{60} *	Cu^{64}	As^{76}	Br^{82}	Rb^{86}	Mo^{99}	I^{131}	$Ce^{141-143}$	W^{185}	Ir^{192}	Au^{198}	Tl^{206}
Target Material	Na_2CO_3	S	KH_2PO_4	K_2CO_3	Sc_2O_3	$CaCO_3$	Fe	Co_3O_4	Cu	As_2O_3	KBr	Rb_2CO_3	Mo_2O_3	Te	CeO_2	Na_2WO_4	IrO_2	Au	$Tl(NO_3)_2$
Grams	0.9	2000	31	22	.002	31	17	0.9	.32	.06	0.9	6.5	10	50	0.83	9.0	.22	.016	10
Inventory 1/31/47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Produced	2	4	9	3	5	13	5	4*	1	1	1	1	1	22	3	1	1	9	1
Inventory 2/28/47	1	0	1	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
To Account For	1	4	8	3	0	13	5	4*	1	1	1	1	1	22	3	1	1	9	1
Disposition:																			
Shipped	1	0	7	3	0	13	5	4*	1	1	1	1	1	0	0	1	1	9	1
Project	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
706-D	0	4	0	0	0	0	0	0	0	0	0	0	0	22	3	0	0	0	0
Buried	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Opr. Dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	4	8	3	0	13	5	4*	1	1	1	1	1	22	3	1	1	9	1

* 8.5g per unit - Special irradiation for National Bureau of Standards to furnish 1c of Co^{60}.

SECRET

SECRET

ISOTOPE PRO. .TION - FEBRUARY, 1947

	FISSION PRODUCTS		SEPARATED MATERIALS				
Isotope	$Element^{43}$	Ba^{140}	CaF_3** ($CaBF_3$)	C^{14}	P^{32}	S^{35}	I^{131}
Inventory 1/31/47	-	-	-	124.81 mc	-	-	-
Produced	109 ugm	1.04 mc	-	-	1449.8 mc	5 mc	1054.3 mc
*Received	-	-	83,500 gm	-	-	-	-
Inventory 2/28/47	-	-	83,379.594gm	116.81 mc	-	-	-
To Account For	109 ugm	1.04 mc	120.406gm	8.0 mc	1449.8 mc	5 mc	1054.3 mc
Disposition:							
Shipped-Isotope	-	-	-	7.0 mc	1269.8 mc	-	1018.3 mc
Shipped-Project	-	-	-	1.0 mc	160.0 mc	5 mc	36.0 mc
-Intraplant	-	1.04 mc	120.406gm	-	20.0 mc	-	-
TOTAL -	109 ugm	1.04 mc	120.406gm	8.0 mc	49.8 mc	5 mc	1054.3 mc
* Material received from Area Engineer. ** Complex of Calcium, Boron and Fluorine containing enriched B^{10}.	1 Shipment	1 Intraplant Transfer	1 Intraplant Transfer	7 Shipments	28 Shipments 1 Intraplant Transfer	1 Shipment	27 Shipments

SECRET

TABLE II

OUTSTANDING ORDERS -2/28/47

Fission Products	Amount (mc)	No. of Shipments
Ba^{140}	20 mc	2
$Ru^{103-106}$-$Te^{127-129}$	5 mc	1
$Ce^{141-144}$	15 mc	2
Pr^{143}, Nd^{147}, Eu^{156}, etc.	10 mc	1
Zr^{95}	425 mc	3
Sr^{89-90}	205 mc	3
$Element^{61}$	2 mc	2
Cs^{137}	5 mc	1
Zr^{95} - Cb^{95}	100 mc	1
TOTAL	787 mc	16

Separated Materials		
P^{32}	2879 mc	64
Ca^{45}	.01 mc	1
I^{131}	1445 mc	43
S^{35}	5 mc	1
TOTAL	4329.01 mc	109

TABLE II

OUTSTANDING ORDERS -2/28/47

Unseparated Materials	Amount (Units)	No. of Shipments
Na^{24}	35	35
P^{32} (S)	5	5
P^{32}	21	21
S^{35}	2	2
Cl^{36}	1	1
K^{42}	9	9
Ca^{45}	3	3
Fe^{55-59}	7	7
Co^{60}	3	3
Cu^{64}	3	3
Zn^{65-69}	1	1
Ga^{72}	1	1
Br^{82}	1	1
$Ag^{108-110}$	1	1
I^{131}	2	2
Au^{198}	36	36
Tl^{206}	2	2
TOTAL	126	126

SUMMARY	No. Orders Outstanding
Fission Products	126
Separated Materials	109
Unseparated Materials	16
GRAND TOTAL	251

SECRET

TABLE III

ISOTOPE SHIPMENT SUMMARY

MATERIAL	SHIPMENTS AUG. THRU JAN.		SHIPMENTS FEBRUARY		TOTAL TO DATE	
	Amount - mg	No. Shipments	Amount - mg	No. Shipments	Amount - mg	No. Shipments
Fission Products:						
Sr^{89-90}	1549.0	8	-	-	1549.0	8
Y^{91}	274.0	3	-	-	274.0	3
$Ru^{103-106}$, $Te^{127-129}$	10.0	1	-	-	10.0	1
$Ru^{103-106}$	2.0	1	-	-	2.0	1
Cs^{137}	2.0	2	-	-	2.0	2
Ba^{140}	90.0	3	-	-	90.0	3
$Ce^{141-144}$	10.0	1	-	-	10.0	1
61^{147}	50.0	1	-	-	50.0	1
61^{149}	0.45	2	-	-	0.45	2
Element 43	-	-	109 ugm	1	109 ugm	1
TOTAL	1987.45	22	109 ugm	1	1987.45	23
Separated:						
C^{14}	70.05	56	8	7	78.05	63
I^{131}	3053.7	100	1054.3	27	4108.0	127
P^{32}	3450.2	63	1429.8	28	4880.0	91
S^{35}	-	-	5.0	1	5.0	1
Pr^{143}	0.74	1	-	-	0.74	1
TOTAL	6574.69	220	2497.1	63	9071.79	283

SECRET

SECRET

TABI II (Cont.)

ISOTOPE SHIPMENT SUMMARY

MATERIAL	SHIPMENTS AUG. THRU JAN.		SHIPMENTS FEBRUARY		TOTAL TO DATE	
	Amount - Units	No. Shipments	Amount-Units	No. Shipments	Amount - Units	No. Shipments
Unseparated Units:						
Na^{24}	2	2	1	1	3	3
P^{32} (S)	3	3	1	1	4	4
P^{32} (KH_2PO_4)	21	21	8	8	29	29
S^{35} (S)	2	2	0	0	2	2
S^{35} (KCl)	14	14	0	0	14	14
Cl^{36}	2	2	0	0	2	2
Ca^{41-45}	5	5	13	4	18	9
K^{42} (K_2CO_3)	9	9	3	3	12	12
K^{42} (KCl)	1	1	0	0	1	1
Sc^{46}	2	2	0	0	2	2
Fe^{55-59}	9	9	5	5	14	14
Ni^{59}	1	1	0	0	1	1
Co^{60}	6	6	4*	1	10	7
Cu^{64}	3	3	1	1	4	4
Zn^{65-69}	2	2	0	0	2	2
As^{76}	1	1	1	1	2	2
Br^{82}	2	2	1	1	3	3
Rb^{86}	0	0	1	1	1	1
Mo^{99}	0	0	1	1	1	1
Ag^{110}	2	2	0	0	2	2
$Sb^{122-124}$	2	2	0	0	2	2
I^{131}	5	5	0	0	5	5
Ba^{131}	1	1	0	0	1	1
Cs^{134}	5	5	0	0	5	5
Ta^{182}	1	1	0	0	1	1
W^{185}	0	0	1	1	1	1
Ir^{192}	0	0	1	1	1	1
Hg^{197}	1	1	0	0	1	1
Au^{198}	30	30	9	9	39	39
Tl^{206}	1	1	1	1	2	2
Special Irradiations	3	3	0	0	3	3
TOTAL	136	136	52	40	188	176

* Special 8.5 grams per unit

SECRET

TABLE III (Cont.)

ISOTOPE SHIPMENT SUMMARY

MATERIAL	SHIPMENTS AUG. THRU JAN.		SHIPMENTS FEBRUARY		TOTAL TO DATE	
	Amount - Units	No. Shipments	Amount -Units	No. Shipments	Amount - Units	No. Shipments
TOTALS:						
Fission Products		22		1		23
Separated Materials		220		63		283
Unseparated Units		136		40		176
GRAND TOTALS		378		104		482

[redacted]

[redacted]

ORNL
MASTER COPY
ORNL
SERIES A

14 a

OPERATIONS DIVISION

MONTHLY REPORT

FOR

MONTH ENDING JUNE 30, 1948

BY

M.E. RAMSEY

E.J. WITKOWSKI

A.F. RUPP

J.A. COX

L.B. EMLET

DECLASSIFIED

Per Letter Instructions Of

TID-1149

E. L. Bonney

For: H. T. Bray, Supervisor Laboratory Records Dept. ORNL

THIS DOCUMENT WAS PROPERLY DECLASSIFIED AND IS EXEMPT FROM THE 1979 REVIEW ORDER PER DOE LETTER, 10-16-79, E.T. DUFF, OCC

R. E. BAKER, ORNL/CO RJ 1/31/80
INITIALS DATE

CLASSIFICATION CANCELLED

DATE 6/27/79 (DOE Review Order)

R. E. Baker

DECLASSIFICATION OFFICER
OAK RIDGE NATIONAL LABORATORY
AUTHORITY DELEGATED BY ERDA 8-15-77

CAUTION

THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES. ITS TRANSMISSION OR THE DISCLOSURE OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED AND MAY RESULT IN SEVERE CRIMINAL PENALTIES UNDER APPLICABLE FEDERAL LAWS.

[redacted]

OAK RIDGE NATIONAL LABORATORY

OPERATED BY

CARBIDE AND CARBON CHEMICALS CORPORATION

FOR THE

ATOMIC ENERGY COMMISSION

[redacted]

Report Number: ORNL-288
This document consists of 22 pages.
Copy 14 of 38 copies. Series A.

ISSUED TO: ______________________

Contract No. W-7405, eng-26

OPERATIONS DIVISION

MONTHLY REPORT

for

Month Ending June 30, 1949

by

M. E. Ramsey
E. J. Witkowski
A. F. Rupp
J. A. Cox
L. B. Emlet

DATE ISSUED
JUL 27 1949

OAK RIDGE NATIONAL LABORATORY

operated by
Carbide and Carbon Chemicals Corporation
for the
Atomic Energy Commission
Post Office Box P
Oak Ridge, Tennessee

DISTRIBUTION

1. G. T. Felbeck
2-3. 706-A
4. 706-B
5. Biology Library
6-7. Training School
8-11. Central Files
12. C. N. [redacted]ucker
13. [redacted]eterson
14. [redacted]einberg
15. [redacted]ender
16. [redacted]gley
17. [redacted]x
18. [redacted]pp
19. [redacted]d
20. [redacted]sey
21. [redacted]kowski
22. [redacted]rtout
23. [redacted]e
24. K[redacted]an
25. J[redacted]on
26. K[redacted]er
27. L[redacted]dan
28. E.[redacted]ngham
29. E.[redacted]y
30. A. H. Snell
31. W. D. Lavers
32. C. S. Harrill
33. L. B. Emlet
34. Technical Information Division, OROO
35-37. AEC, Washington
38. H. J. McAlduff

CAUTION

This document contains information affecting the National Defense of the United States. Its transmission or the disclosure of its contents in any manner to an unauthorized person is prohibited and may result in severe criminal penalties under applicable Federal law.

[redacted]

This docu[redacted]fined in the Ato[redacted]

[redacted]

SUMMARY

1. Lost pile operating time averaged 10.3% as compared to 11.9% for the last month. (Page 4.)
2. The bearings on the No. 2 fan were replaced during the month. (Page 5.)
3. Minor difficulties in P^{32} production caused delay in several shipments. Development work indicates that this process will be greatly improved as soon as new equipment is available in the Isotope Area. (Pages 7 and 8.)
4. The chemical waste evaporator was placed in service this month. A 50% reduction in activity discharged to the Settling Basin resulted. (Page 13.)
5. RaLa Run No. 34 is scheduled to start July 9, 1949, with shipment about July 17, 1949. (Page 16.)
6. During June, 447 shipments of radioactive materials were made to bring the total since August, 1946, to 8,482. (Page 17.)
7. Effective July 1, 1949, the millicurie used for shipping I^{131} was changed to an absolute value. The millicurie formerly used was 1.75 times this new figure. (Page 17.)
8. The Radioisotope Processing Area is expected to be completed by September 1, 1949. The Office Building was occupied on June 16, 1949. (Page 19.)

A. PILE DEPARTMENT

I. Operating Data:

	JUNE 1949	MAY 1949	YEAR-TO-DATE 1949
Total Accumulated KWH	2,304,835	2,476,540	15,128,865
Average KW/operating hour	3567.31	3779.06	3840.73
Average KW/24-hour day	3201.16	3328.68	3482.70
Percent Lost Time	10.3%	11.9%	9.3%
Approx. Excess Pile Reactivity	80-90 inhours	80-90 inhours	
Slugs Charged	83	101	2056
Slugs Discharged	33	149	2004
Product Made (grams)	84.12	90.39	525.15
Product Discharged (grams)	0.22	1.84	142.76

II. Pile Operation:

The pile-down time averaged 10.3% compared to 9.3% for the year-to-date. The slight increase in pile-down time was due principally to lost time in connection with the installation of a new Safety rod in Hole 8. The installation was made somewhat complicated due to the vertical liner through the pile shielding being out of line with the channel in the graphite.

The new Safety rod was built and installed to determine whether replacement of the four older-type Safety rods with the new and larger type would give a poison effect equivalent to the total of the present Safety and Shim rods. If an equivalent or greater poison effect is obtained, it will be feasible to remove the two Shim rods on the north side of the pile and built better balconies, increasing the number of available holes and space for research work.

No ruptured nor swelled slugs were detected during the month.

The fuel assembly was installed during this month in Hole 11 for evaluation by personnel from the Argonne National Laboratory. Some difficulty was experienced early in the month because of the use of a faulty lead shield. Repairs have been made and the experiment is progressing satisfactorily.

The excess pile reactivity has remained constant at eighty to ninety inhours throughout the month.

III. Filter House:

The following table compares the pressure drops of last month and this month with that experienced immediately after replacement of filters:

	F. G. #50 GLASS WOOL FILTERS		C.W.S. #6 PAPER		ACROSS HOUSE	
Date	Inches w.g.	% Increase	Inches w.g.	% Increase	Inches w.g.	% Increase
Clean filters	1.1	--	1.0	--	3.3	--
5-31-49	3.5	+227%	1.7	+70%	6.4	+91%
6-30-49	3.3	- 6%	1.8	+ 6%	6.3	- 2%

Filter House operation was normal throughout the month.

IV. Fan Operation:

The bearings on No. 2 fan were replaced on June 15, 1949, due to the failure of the south bearing race. This set of bearings was in service fourteen months. This is the best service that has ever been given by a set of fan bearings on these fans.

Even though fan-bearing performance is still not satisfactory, our recent experience is somewhat improved over the initial operation of the bearings. The first ten sets of bearings gave an average life of one and one-fourth months, whereas the last ten sets of bearings have given an average life of slightly over four months.

Fan House operation was normal except for the bearing failure on No. 2 fan.

V. Radioisotopes:

The following table is a comparison of the radioisotope and research samples charged into the pile during June, 1949, with those handled in May, 1949:

Stringers 13, 14, and 15 90 83 13 104

V. Radioisotopes: (Continued)

	JUNE, 1949		MAY, 1949	
	Research	Radioisotopes	Research	Radioisotopes
Stringers 13, 14, and 16	90	83	13	104
Hole 22 (Pneumatic Tube)	64	2	77	1
All Other Holes	8	16	5	22
TOTAL BY GROUPS	162	101	95	127
TOTAL FOR MONTH	263		222	

At the end of June, 1949, there were 389 cans of target material in Stringers 13, 14, and 16, compared to 360 cans of target material in these stringers at the end of May, 1949.

B. CHEMICAL SEPARATIONS AND ISOTOPE DEVELOPMENT DEPARTMENTS

I. Radioisotopes:

1. Iodine (I^{131} - 8d)

Twenty-three uranium slugs were processed and approximately 10,400 millicuries were shipped. All products were within specifications.

The lower than usual yields are a result of a high loss from nitrate contamination in the first run, the cause of which is still unknown.

2. Phosphorus (P^{32} - 14.3d)

Eighteen, 2000-gram cans of irradiated sulfur were processed and approximately 5,000 millicuries were shipped.

2. Phosphorus (P^{32} - 14.3d) - (Continued)

The lower yields this month are a result of the following:

a. Losses due to activity hold-up by large amounts of silica in the evaporator.

b. Losses in repurification of some products which showed a precipitate at a pH7.

c. Some Losses in the extraction step.

d. A short irradiation time for some of the cans.

The new hood containing the two new evaporators mentioned in last month's report was put into operation.

Phosphorus Development Work

Work on the cation-anion resin process for purification of P^{32} continued with investigation of the sizes of columns and weight of resin required for full-scale runs. Tests indicate that P^{32} losses on the cation column (Dowex 50) will run less than 1% if the total iron content of the extraction liquor is kept below 50 mg. This condition should be easily met with the glass-lined extractor. One gram of Dowex A-1 or A-2 anion resin will handle 1-2 milliequivalents of anion, so it is expected that approximately 100 grams of resin will be required for the full-scale equipment. The anion column section will be divided into two parts, one large column to remove the bulk of the sulphate and phosphate, and a small one to complete the purification of the P^{32} band eluted off of the large column. The P^{32} band will be followed by means of a slotted ionization chamber, similar to the way bands are followed in fission product separations. It will be necessary for the anion column system to be completely closed and free from CO_2, because sodium hydroxide is used for

2. Phosphorus Development Work - (Continued)

the regenerating solution with these resins and any carbonate taken up results in the discharge of CO_2 gas in the column during the acid cycle.

An ORNL-type welded slug containing 100 grams of sulfur was exposed to fast neutrons for two weeks between two uranium slugs in a regular channel. This slug has been discharged and examined in the canal. It looks normal; no swellings or other malformations were noted. Full data on this slug will be reported later. Four more slugs of this same type are ready for insertion into the pile. So far, welding slugs well enough to pass the leak tests has proved very difficult; rejects are running about 60%. Various welding techniques will be tried until a good one is found.

Several production runs in Cell 5 have been followed closely to determine the source of occasional traces of cations in the product. Several places in the procedure were found where the efficiency of cation removal could be improved.

3. Carbon (C^{14} - 5100y)

No runs were made on the $Ca(NO_3)_2$ process this month.

C^{14} Development Work (Be_3N_2 Process)

A process was developed for preparing pure $BeCl_3$ from our Be_3N_2-C^{14} process waste. A quantity of this material, containing Be^{10}, is needed by the Physics Division, to be processed by Y-12 to produce enriched Be^{10}. The process used is as follows: $BeSO_4(NH_4)_2SO_4$, the dry waste material obtained from our process, is converted to BeO by baking. The BeO is treated with carbon and chlorine gas at 450°C., the $BeCl_2$ volatized and condensed in a closed system. $BeCl_2$ is an extremely hygroscopic

3. C^{14} Development Work (Be_3N_2 Process) - (Continued)

material. $BeCl_2$ is of interest to us also in that it may be possible to prepare the nitride from it without converting beryllium back to metallic form. The balance of the preparations of $BeCl_2$ will be done by Y-12 in their large facilities; we will furnish the BeO containing Be^{10}.

Work continued on the H_2O_2 process for production of C^{14} from Be_3N_2. Results have been favorable and indications are that this method will be used in place of the chromic acid procedure, thus simplifying design of our ten-slug plant in the new Isotope Area.

Inventory of C^{14} resulting from development work is as follows: Less than 3% isotopic ratio, 70.3 mc; 3% to 6%, 3.2 mc; 6% to 9%, 39.2 mc; 10% and over, 33.4mc; total, 207.19 mc.

4. Sulfur (S^{35} - 87d)

A routine preparation of two curies of BaS^{35} was made this month. The analysis is not completed.

5. Fission Products

A sampler and new equipment for removing products from the cell were installed this month. The sampler was installed in order to obtain rough preliminary analyses of the various fractions as they are eluted from the columns. The new handling equipment has reduced exposure to radiation.

Runs SS-15 and SS-16 were in progress during the month. SS-15 was made up from one and a half, sixty-day slugs and was well along in process when a spacial order for Ba^{140} was received requiring immediate shipment. The lower fractions, Y to Sr, were dropped out rapidly with 3.5 pH citrate and the Ba^{140}

5. Fission Products - (Continued)

removed at pH 7.0. Three hundred millicuries of pure Ba^{140} were shipped; the other fractions will be removed on auxiliary columns.

Run SS-16 was made up from three-year slugs, cooled one and a half years. This run is bring made particularly to recover Cs^{137}.

a. Zr^{95}-Cb^{95} (Zr^{95}-65d, Cb^{95}-35d)

Approximately 10 mc of purified Cb^{95} was produced by the TTA process. The product is slightly different than usual in that this preparation is stored in 0.01 M HCl instead of oxalic acid solution. Glass storage bottles treated with dimethyl silicone vapor can apparently be used successfully to store uncomplexed Zr-Cb without undue adsorption losses on the glass.

b. Yttrium (Y^{91} - 57d)

None produced this month.

c. Rare Earths (Nd^{147}-11d, 61^{147}-3.7y, Pr^{143}-14d)

None produced this month.

d. Cerium ($Ce^{141-144}$ - 28d,280d)

Two curies of old cerium (Ce^{144}) were obtained from the Chemistry Division and are being separated from Pu.

6. Ruthenium (Ru^{106} - 1y)

No concentrations were made.

Ruthenium Development Work

A Ru^{106} test plaque was made according to a customer's specifications and shipped. Approximately five microcuries of Ru^{106} were plated onto a gold plaque 1" in diameter. Inactive ruthenium was added to the plating preparation so that the Ru metal deposit weighed 0.00012 g.; this was covered with

6. Ruthenium Development Work - (Continued)

a thin gold plate weighing 0.0010 g. This makes the total absorber about 0.2 mg/cm^2, which will not absorb a significant amount of the 4 MEV beta radiation from the rhodium daughter of Ru^{106}. This plaque was shipped in a slotted Lucite block.

7. Calcium (Ca^{45} - 180d)

No Ca^{45} was produced this month.

8. Strontium (Sr^{89-90} - 55d, 30y)

Processing of the fifteen-curie batch of Sr^{90}, referred to in the last report, has been set aside indefinitely, since existing orders for Sr^{90} can be filled from material made by the Chemical Separations Department. Manpower being used on this operation is needed on other problems at this time.

9. Iron (Fe^{55-59} - 4y, 44d)

The analysis of the iron preparation reported last month is as follows:

Total Activity	-	60.5 mc Fe^{59}, 70.0 mc Fe^{55}
Concentration	-	Fe^{59} - 0.252 mc/ml
Concentration	-	Fe^{55} - 0.279 mc/ml
Concentration	-	Total Fe - 53 mg/ml
Specific Activity	-	Fe^{59} - 4.8 mc/g. Fe
Specific Activity	-	Fe^{55} - 5.3 mc/g. Fe
Acidity	-	0.484 N in HCl

A sample,enriched (Y-12) Fe^{58}, which had been irradiated at Hanford was processed. The analysis is as follows:

Total Activity	-	43.2 mc Fe^{59}, 1.91 mc Fe^{55}
Concentration	-	Fe^{59} - 0.72 mc/ml
Concentration	-	Fe^{55} - 0.03 mc/ml
Concentration	-	Total Fe - 0.8 mg/ml
Specific Activity	-	Fe^{59} - 900 mc/g. Fe
Specific Activity	-	Fe^{55} - 40 mc/g. Fe
Percent Fe^{55}	-	4.27%

10. Zinc (Zn^{65} - 250d)

A Hanford sample was processed to give a product with the following analysis:

Total Activity	-	2,570 mc
Concentration, Zn^{65}	-	25.7 mc/ml
Concentration	-	Total Zn, 58.3 mg/ml
Specific Activity	-	440.8 mc Zn^{65}/g. Zn
Free Acid	-	0.033 N HCl

11. Miscellaneous

a. Two encapsulated, calibrated Co needles were prepared for a customer. The needles were placed in stainless steel sheaths and sealed with paraffin for easy removal. These samples were calibrated against Bureau of Standards needles, giving the value 1.037 mc/cm.

b. A cerium source (Ce^{144}) is being prepared for a customer who submitted a special gold-plated source holder for this purpose. A pin-hole was discovered in the gold plate, delaying the preparation until a new gold plate can be put on.

c. The separation of Be^7 from a lithium cyclotron target reported last month yielded one millicurie of 99.9% pure Be^7. The material has been shipped.

d. Separation and analytical work has been completed on the old RaLa sample to determine the long-life radioactive contaminants. The data are now being assembled and calculations made. A memo-report will be issued on this subject.

II. Tank Farm and Burial Ground:

1. Wastes Discharged to the White Oak Creek

a. Approximately 63.45 curies of beta activity were discharged from the Settling Basin this month. This was an average of 2.11 curies per day or only about one half of the quantity discharged last month. This was due to the chemical waste evaporator being put into service this month, which concentrates the active solutions for storage and thus eliminates excessive discharge of activity to the Settling Basin.

b. On June 2, 1949, the first full-scale run, using hot waste from W-5, was started in the chemical waste evaporator. To date, ten runs have been made with occasional trouble being experienced by the concentrate foaming over from the evaporator to the condensate catch tank. In order to minimize these foam-overs, Dow-Corning Anti-Foam is being used.

One mechanical failure has occurred which caused a loss of approximately eight hours' time. The gate in the valve from the condensate tank to W-5 stuck and had to be replaced. An acid wash from the feed tank to the evaporator was enough to decontaminate the equipment so that this work could be done.

Beginning next month, the results of the evaporator operation will be tabulated to show the amount of waste evaporated, the volume reduction, and the approximate decontamination factor.

c. To make room for the evaporator concentrate, 102,000 gallons of waste from W-6 was jetted from W-6 to the East Pond. This contained about 175 curies of beta activity.

d. A survey is being made to determine the feasibility of locating a new Burial Ground at a point, near the White Oak Creek, which is considered more desirable from a geological standpoint. Preliminary estimates indicate that the cost of such a project would range between \$10,000 and \$20,000. Numerous core drillings have been made over an area of about four to five acres and only two holes have shown rock closer than fifteen feet from the surface. This would indicate the soil is suitable for digging large holes.

e. The following table shows the discharge of activity to the White Oak Creek:

Discharged From	Gallons	Curies
Settling Basin	22,577,000	63.45
Retention Pond	274,000	0.2

2. Waste Tank Inventory

Tanks	Gallons Capacity	Gallons In	Gallons Out	Discharged To	Free Space
			CHEMICAL WASTE STORAGE		
W-5	170,000	--	113,890	Evaporator	62,400
			HOT PILOT PLANT STORAGE		
W-3	41,300	5,624	16,576	Evaporator	14,800
			EVAPORATOR CONDENSATE		
W-6	170,000	4,200	--	--	108,000
			METAL WASTE		
W-4,7, 8,9,10	713,000	3,272	--	--	93,216

3. Special Wastes

a. A total of 511.21 kg of uranium was received into the metal storage system this month. Of this, the Hot Pilot Plant transferred 315.4 kg; the Technical Division, Section I, 165.3 kg; I^{131} process, 30.42 kg; Technical Division, Section IV, .09 kg.

b. About 17.64 kg of uranium were transferred to the Technical Division, Section I, from W-10 tank for metal recovery studies.

c. Two shipments of alpha-contaminated material from Dayton.

d. Two shipments of contaminated trash from K-25 were buried.

III. RaLa (Ba^{140} - 12.5d):

RaLa Run No. 34 is scheduled to start July 9, 1949.

The two variacs, burned out during RaLa Run #33, have been repaired and a new glassware reactor has been placed in the cubicles in preparation for Run #34.

Investigation disclosed the A4-205 off-gas line condensate pit as a source of air contamination during RaLa Run #33. A small blower has been installed which will vent the air from this pit to above the 706-D roof level. Its effect will be determined during RaLa Run #34.

The A-16 off-gas lines and filter box are being relocated to provide room for the concrete pad which is adjacent to the new 900 Area off-gas stack. This work should be completed before July 9, 1949.

C. ISOTOPE CONTROL DEPARTMENT

I. General:

There were 447 isotope shipments during the month of June compared with 511 during May.

During most of the month there was a shortage of P^{32} due to processing difficulties.

The breakdown of shipments according to separated and unseparated material is as follows:

	MAY 1949	JUNE 1949	TOTAL August, 1946, to June, 1949, Inc.
Separated Material 706-D Area	382	332	6,539
Unseparated Material 100 Area	129	115	1,943
	511	447	8,482

The breakdown of shipments according to non-project, project, and foreign shipments for May and June is as follows:

	MAY	JUNE
Non-Project	418	367
Project	64	54
Foreign	29	26
	511	447

II. Phosphorus 32:

The University of California reported a precipitate in one shipment of P^{32} during the month and further work is in progress to determine the cause.

III. Iodine 131:

A series of investigations at ORNL and at the Bureau of Standards during the past year indicated that the quantity of I^{131} which was being shipped as a millicurie was 1.75 times too great. Effective July 1, 1949, the I^{131} content has been corrected and the price adjusted accordingly.

IV. Handling Charges:

Effective July 1, 1949, all handling charges were reduced to $10.00 at the request of the Atomic Energy Commission. This will considerably simplify pricing of isotope shipments and will not result in an appreciable decrease in revenue.

V. Ruthenium 106:

A considerable demand for ruthenium 106 plated on metal appears to lie in thickness gages. A number of these gages have been prepared by Tracerlab and other isotope processing concerns using strontium 90 fused on ceramic surfaces. It is believed that ruthenium plated on metal will prove even more satisfactory for such an application because self-absorption can be better controlled and also because the rhodium daughter of ruthenium has a higher energy beta ray than the Sr^{90}-Y^{90}. Ruthenium sources plated on metal also appear to have promising applications in medicine as sources of beta radiation. Among the uses suggested to date are radiation of skin and eye tumors and radiation of the inside of the stomach to reduce acid secretion and thus encourage healing of ulcers.

VI. Antimony-Beryllium Neutron Sources:

The Atomic Energy Commission has approved the following selling prices for Sb-Be neutron sources:

Antimony-Beryllium Source	$44.00
Service Irradiation of the Source	43.00/month
Returnable Deposit on Container	400.00

VII. Radioisotope Processing Area:

In the Isotope Processing Area work continued on all buildings. The office building was completed and occupied on June 16, 1949. Work in the analytical building included completion of the roof, tile walls, acid-proof floor and walls of the decontamination room, the concrete storage barricade, and approximately seventy percent of the lead isotope loading barricade; also, work continued on installation of the service piping, electrical wiring, and exhaust ducts. In the process buildings work continued on the service piping, exhaust ducts, electrical wiring, and the interior aluminum walls; installation of the lead barricades was started in Buildings D and E. The fog fire-protection system was installed in the column building and tested. The interiors of the decontamination and service buildings were painted, and painting was started in other process buildings.

The concrete roadway was poured west of the analytical building and D and E process buildings, and north of the analytical and office buildings. In the stack area installation of the semi-hot drains, the hot drains, and the hot off-gas lines was started. Also, pads were poured for the other two blowers, and installation of one of the blowers started.

L. B. Emlet, Director
Operations Division

wp

VIII. Source and Fissionable Material Accountability:

A complete audit of several individual accounts was conducted by Mr. D. George, Washington SF Accountability Office, and Mr. H. Kilburn of the Oak Ridge Operations Office. Accounts checked in detail were: Drs. S. Siegel, W. Johnson, L. Roberts, and D. Billington.

The Atomic Energy Commission quarterly accountability survey unit was made by Dr. C. Luke, Syracuse University, accompanied by T. Haycock and P. Selak of Oak Ridge Operations. A field trip covered the following divisions: Physics, Chemistry, Technical, Metallurgy, and Operations.

During the month a total of 69.5 kilograms of normal uranium was discarded because of the inadequate Tank Farm distribution system.

Two people were added to the department for assistance in devising a sample control system for accountability of all fissionable sample transfers.

The Accountability Office was moved to Room 103, Building 105.

Following is a summary of shipments and receipts of SF Materials for the month of June, 1949:

RECEIPTS

Received From	Material	Content
Argonne National Laboratory	Waste Solution	229.00 mg Pu
" " "	12 Zr Class U/Zr Plates	640.14 gm
" " "	Waste Solution	107.00 gm Normal 12.00 mg Pu
" " "	Enriched U308 on Platinum	1.11 mg
" " "	Waste Solution	395.00 mg Pu
" " "	Waste Solution	17.23 kg Normal 67.00 mg Pu
Carbide & Carbon Chem. Corp.	Uranium Metal Waste Solution	16,200.00 gm Normal 90.00 mg Pu
C&CCC, Y-12 Area	Normal Uranium Rods	116,700.00 gm
" " "	Normal Uranium Rods	335.50 gm
" " "	Depleted Uranium	4.90 gm
" " "	Uranyl Nitrate Crystals	No weights available
General Electric Company	Standard Redox Solution	1.55 lbs.

SHIPMENTS

Shipped To	Material	Content
Argonne National Lab.	Pu Solution 1.3M $Al(NO_3)_3$	8.88 gm Pu
C&CCC, K-25 Area	UNH S	2.15 kg
" " "	UAP Cake, Normal Uranium	54.50 kg
" " "	1 Drum UAP Cake, Normal Uranium	87.50 kg
C&CCC, Y-12 Area	U_3O_8 Enriched Uranium (90 to 95%) (for analysis and assay)	0.49 gm
" " "	Al-U Alloy Enriched Uranium (90 to 95%) (for analysis)	2.445 gm
" " "	Al-U Alloy Enriched Uranium (38.0%) (for analysis)	0.70 gm
" " "	U-Al-Alloy-Depleted (for recovery)	2.5483 gm
" " "	U-Al-Alloy Enriched Uranium(for recovery)	0.5023 gm
" " "	U-Al-Alloy Enriched Uranium (47.2%) (for recovery)	1.25 gm
" " "	U-Al-Alloy Enriched Uranium (90 to 95%) (for recovery)	0.5079 gm
" " "	U_3O_8 Enriched (90 to 95%)(for salvage)	0.6500 gm
" " "	Uranyl Nitrate (85.4%) (for analysis and assay)	0.561 gm
" " "	Enriched Uranium Compounds (90 t0 95%) (for analysis and assay)	2.496 gm
" " "	Enriched Uranium Compounds (85 to 90%) (for salvage)	0.550 gm
" " "	U-Al-Alloy Solutions (90 to 95%) (for salvage)	2.9189 gm
" " "	Black Oxide U_3O_8 (90 to 95%) (for salvage)	0.4019 gm
" " "	Waste Solution (94.8%)(for salvage)	0.2800 gm
" " "	Waste from UO_3 Sample(83.5%)(for salvage)	0.0672 gm
" " "	2 Pieces U-Al-Alloy(94.8%)(for salvage)	1.7300 gm
" " "	UO_3 (10.3%)	36.5400 gm
" " "	Foil Trimmings (93.3%)(for salvage)	0.4283 gm
" " "	12 Enriched Uranium Slugs (93.5%)	135.5000 gm
North Amer. Aviation Inc.	Normal Uranium Al-Foils	4.15 gm
Fairchild Eng.& Airplane Corporation	10 Pt. plated and 3 Pt. Strips containing Pu Alpha Source	3.00 mg Pu
" " "	Normal Uranium	250.57 gm
U.S. Naval Supply DepotNY	10 ml Redox Dissolver Solution	4.80 gm Normal
" " " "	5 ml Redox 1 AW Waste Stream	Nil
" " " "	100 ml Redox Uranium Solution in Hexone	7.50 gm
" " " "	200 ml UNH Solution Redox 2nd Cycle Uranium Product	29.00 gm
" " " "	10 ml Redox Solution	Nil
" " " "	100 ml Redox ICU Solution	14.80 gm
" " " "	200 ml Redox Solution(Pu) as Nitrate	52.60 mg Pu
" " " "	200 ml Redox Pu Solution as Nitrate	62.80 mg Pu

[redacted]

SHIPMENTS - (Continued)

Shipped To	Material	Content
US Naval Supply Depot NY	25 ml Uranium & Pu Solution in Hexone	2.8 gm Normal 0.8 mg Pu
" " " "		
" " " "	10 ml Redox 1st Cycle Feed Solution	4.8 gm Normal 1.3 mg Pu
" " " "	3 liters Redox 2nd Cycle Waste Solu.	Nil
" " " "	3 liters Redox UNH Solution (1st Cycle U Product)	459.00 gm
Westinghouse Elec. Corp.	Normal Uranium Be Rods	.03 kg

[redacted]

SECRET

Progress Report

MASTER COPY

AEC RESEARCH AND DEVELOPMENT REPORT

LABORATORY RECORDS

CLASSIFICATION CANCELLED
(DOE Review Order)
DATE JUN 29 1979

DECLASSIFICATION OFFICER
OAK RIDGE NATIONAL LABORATORY
AUTHORITY DELEGATED BY ERDA 8-15-77

OPERATIONS DIVISION

MONTHLY REPORT FOR MONTH
ENDING DECEMBER 31, 1949

OAK RIDGE NATIONAL LABORATORY

OPERATED BY

CARBIDE AND CARBON CHEMICALS DIVISION

UNION CARBIDE AND CARBON CORPORATION

POST OFFICE BOX P

OAK RIDGE, TENNESSEE

This document consists of 39 pages
No 5 of 41 copies, Series A

~~SECRET~~

REPORT NUMBER: ORNL-584

ISSUED TO: ____________

Contract No. W-7405, eng-26

OPERATIONS DIVISION

MONTHLY REPORT

for

Month Ending December 31, 1949

By Authority Of AEC 8/22/1970

by

M. E. Ramsey
E. J. Witkowski
A. F. Rupp
J. A. Cox
L. B. Emlet

DATE ISSUED

FEB 13 1950

OAK RIDGE NATIONAL LABORATORY

operated by
Carbide and Carbon Chemicals Corporation
Union Carbide and Carbon Corporation
Post Office Box P
Oak Ridge, Tennessee

~~RESTRICTED DATA~~

~~SECRET~~

CAUTION

This document contains information affecting the National Defense of the United States. ... its contents ... person is ... criminal penalties under Federal laws.

DISTRIBUTION

1. G. T. Felbeck
2-3. 706-A
4. 706-B
5. Biology Library
6-7. Training School
8-11. Central Files
12. C. N. Rucker
13. J. A. Lane
14. A. M. Weinberg
15. A. Hollaender
16. E. A. Bagley
17. J. A. Cox
18. D. G. Reid
19. A. F. Rupp
20. M. E. Ramsey
21. E. J. Witkowski
22. H. F. Stringfield
23. J. A. Swartout
24. J. H. Frye
25. K. Z. Morgan
26. J. S. Felton
27. K. A. Fowler
28. L. P. Riordan
29. E. J. Murphy
30. A. H. Snell
31. W. D. Lavers
32. C. S. Harrill
33. H. J. McAlduff
34. C. E. Winters
35. L. B. Emlet
36. Technical Information Division, OROO
37-39. AEC, Washington
40-41. Hanford Engineer Works

SUMMARY

1. A comparison of pile operating data for the years 1948 and 1949 indicates the following:

	1948	1949	
Total Accumulated KWH	27,706,628	29,072,468	+5%
Average KW/operating hour	3713.6	3663.36	-2%
Percent Lost Time	15.1%	9.4%	+60%
Samples Irradiated	2171	2570	+18%

More details available on Pages 5, 6, and 12.

2. One ruptured slug was located and discharged without difficulty. A total of fourteen jacket failures occurred in 1949 and a like number in 1948. (Page 6.)

3. Approximately forty inhours were consumed by the loading of a pneumatic tube and gold slugs to Channel 2079. This leaves about one hundred excess inhours. (Page 9.)

4. The glass wool filters were changed in Cell 2 during the month with a resulting gain of 0.9" w.g. in the pressure across the Filter House. (Page 10.)

5. The completion of Plan "H" work in the Pile Building is behind schedule. (Page 9.)

6. The I^{131} and P^{32} process equipment is working satisfactorily. All back orders have been filled. (Pages 13, 14, 15, and 16.)

7. New Sr^{90} processing equipment has been installed in Building 907 and will be ready for operation by the middle of January. (Page 20.)

8. A summary of the cyclotron targets received and on orders is listed. (Pages 22, 23, and 24.)

9. An average of 267 millicuries/day of beta activity was discharged from the Settling Basin to White Oak Creek, as compared to 600 millicuries/day for November, 1949. This figure of 267 millicuries/day (8 curies/month) is compared to an average of 140 curies/month for the first

SUMMARY - (Continued)

9. five months of 1949, before the installation of the Waste Evaporator. (Pages 25 and 26.)

10. A review of the RaLa operation for 1948 and 1949 reveals the following:

	1948	1949
Number of Runs	6	9
Curies Isolated	13,896	28,073
Average Curies/Run	2,310	3,115
Chemical Yield	68%	60.5%
Pounds Uranium Used	11,619	3,863

(Pages 29 and 30.)

11. There were 430 radioisotope shipments during the month, compared to 542 during November, 1949. (Page 31.)

12. A comparison of radioisotope shipments during 1948 and 1949 reveals the following: (Page 31.)

	1948	1949	
Total Shipments	3,543	5,597	+57%

13. An allocation of one hundred inhours in the Hanford piles will ease the Co^{60} shortage by the end of 1950. (Pages 32 and 33.)

14. Neutron Activation Analytical methods are under investigation by personnel from the Chemistry Division. (Pages 33 and 34.)

15. Installation of equipment in the Decontamination Building was completed and operation started. Hood ventilation and off-gas facilities will be available by January 15, 1950, so that processing in the new Radioisotope Area can be started. (Page 35.)

A. PILE DEPARTMENT

I. Operating Data:

	DECEMBER 1949	YEAR 1949	YEAR 1948
Total Accumulated KWH	2,432,071	29,072,468	27,706,628
Average KW/operating hour	3612.96	3663.36(1)	3713.60(1)
Average KW/24-hour day	3268.91	3318.77	3154.22
Percent Lost Time	9.0	9.4	15.1
Approx. Excess Pile Reactivity	90-100 inhours		
Slugs Charged	172	3377 (2)	11,283 (2)
Slugs Discharged	215	3339 (2)	8,672 (2)
Product Made (Grams)	88.76	1061.04	1011.20
Product Discharged (Grams)	13.07	248.58	281.03

(1) Loss due to increased pressure drop because of Filter House installation.

(2) Hanford slugs were used for the 706-D operation during 1949.

II. Pile Operation:

The pile-down time was 9.0% for the month, compared to 9.4% during 1949, 15.1% during 1948, and 8.3% during 1947. Approximately 1.5% of the pile-down time during 1949 was due to the visual scanning of the pile each week. The weekly visual scanning includes use of the channel scanner on all channels containing thermocouples. Weekly visual scanning of the pile was started during September, 1948.

The average pile power per operating hour was 3663.36 KW during 1949 and 3713.60 KW during 1948. The approximate fifty-KW decrease was due to the extra pressure losses caused by the use of the Filter House installed during November, 1948. The additional pressure losses incurred by use of the filters were partially offset by installation of duct work of adequate size from the Pile Building wall to the entrance of the Fan House. The initial duct was designed for lower air flows and when used in conjunction with the current

II. Pile Operation: - (Continued)

fans, duct velocities in the original duct are over twice the velocity used in good engineering practice. However, since the average pressure loss across the filters will be larger in the coming year than it was with the clean filters, the average pile power will reflect this in another small power decrease if no changes are made in operating conditions. Since the current fans have given unsatisfactory bearing performance, new fans of slightly higher capacity are to be installed during the coming year and should offset the small power decrease due to higher pressure losses across the filters.

A ruptured slug was located in Metal Channel 2372 by visual inspection on December 5, 1949, and was discharged without difficulty. It had been in the pile 1865 days at a metal temperature of approximately 200°C. The slug was in the early stages of rupture and very little, if any, of the oxidized material had escaped from the jacket. The probe gave no interpretable indication of the presence of the ruptured slug.

The number of ruptured slugs detected and discharged in 1947, 1948, and 1949 remained relatively constant at thirteen, fourteen, and fourteen, respectively. An increase in the frequency of ruptures had been anticipated, but did not occur even though the average age of the metal in the pile has now reached almost five years. While the life of the aluminum jackets is not known, exposure time can logically be expected to be one of the factors affecting rupture. This factor should eventually cause an increase in the frequency of rupture.

II. Pile Operation: - (Continued)

The graphite cube has already been contaminated to such an extent with exposed uranium from ruptures so that detection of new ruptures by monitoring the pile exhaust air is practically impossible. The situation has progressed to the point where the only reliable method of detecting ruptures is the weekly visual scanning of the metal channels. It is felt that this method gives reasonable possibility of detection of any rupture before it reaches an advanced stage. The probe, at one time a reliable indicator of a rupture, has been of questionable value as a rupture detector since the very serious slug rupture in Metal Channel 2079 during December, 1947. During 1949, only three of the fourteen ruptures gave an interpretable indication of their presence on the probe.

The use of a gummed-tape instrument, designed to hold particles that had impinged on a tape passed through the exit air stream carrying the particles to an external counter, was evaluated this year. Since it was of even less value than the oil-soaked probe as a rupture indicator, its use has been discontinued.

A second instrument, based on an ability to collect and measure the radioactivity of solid radioactive decay products from gaseous fission products, was found to be of no value as a scanner of the entire exit air stream due to the presence of exposed uranium trapped in the pile from previous ruptures. This instrument has, however, proved to be a rather reliable individual metal channel scanner and is used only for this purpose.

Although no serious difficulty was caused by slug failure in 1949, jacket rupture is becoming a more serious problem. In view of this, and since an additional supply of X-slugs will be necessary

II. Pile Operation: - (Continued)

during 1950, efforts are being made to obtain aluminum-silicon bonded slugs made according to the Hanford technique. It is expected that the Al-Si bonded slugs will reduce the frequency of ruptured jackets and permit the slug jacket temperatures to be raised from the current maximum of 245°C. to a maximum of 350°C. with an accompanying increase in pile power and neutron flux of thirty to thirty-five percent. This will materially help both the research work and radioisotope program at ORNL.

Methods of catching the bulk of the radioactive particulate matter accompanying the removal of objects from the pile were devised early in the year. The methods in general were wiping with a damp cloth or a combination of brushes and a vacuum exhaust system. A very marked decrease in the amount of particulate radioactivity discharged into the Pile Building has been made, but it has been found virtually impossible to eliminate such particles completely. Some further improvement is expected to be made early in 1950 by installation of a belt conveyor as a replacement for graphite stringers used in Holes 13, 14, and 16.

The Hole 22 pneumatic tube, which extended through the pile, was removed during construction of the south experimental balconies. A new pneumatic tube facility was installed during December consisting of two tubes extending only from the south face to the middle of the pile, making the north half of the hole available for other work. The larger tube takes the original size rabbit with inside dimensions of three-fourths inch in diameter and two and three-eighths inches in length. The new tube takes rabbits with inside dimensions of seven-sixteenths inch in diameter and two inches in length.

II. Pile Operation: - (Continued)

A pneumatic tube was installed in Metal Channel 2079 on December 12,1949. This tube is to be used to activate large gold sources for gamma radiation damage studies.

The excess pile reactivity is between ninety and one hundred inhours. The approximate forty-inhour decrease from last month was due principally to the insertion of the gold sources in Metal Channel 2079. Sufficient reactivity has been available at all times during the year to permit the installation of all equipment desired and still have an adequate reserve for good pile control.

The permanentization as scheduled under Plan H will provide a new change house and storage room in the area west of the Pile Building and north of the core annex, replacement of the south balconies with stronger steel and concrete air-conditioned balconies, replacement of the control wiring of the pile, a complete painting and re-roofing of the Pile Building, new inlet air filter house, replacement of the wood frame portion of the Fan House, and replacement of the pile cooling fans. The new change house and storage room was started during September, 1949, and is slightly over half completed. The replacement of the south experimental levels was started during October, 1949, and is now about ninety percent completed. The balcony construction program still causes some difficulty to research workers in the south balconies.

The duct work for the central air-condition system to be used for the south balconies has been installed, but the unit itself has not arrived. Except for the painting of the inside of the Pile Building, which is perhaps two-thirds completed, and re-roofing, which is also about two-thirds completed, the other permanentization

II. Pile Operation: - (Continued)

items are in various stages of design with no construction having been started.

III. Filter House:

The following table compares the pressure drop across the exhaust air filters of last month and this month with that experienced immediately after replacement of the filters:

	FG #50 GLASS WOOL FILTERS		CWS #6 PAPER		ACROSS HOUSE	
Date	Inches w.g.	% Increase	Inches w.g.	% Increase	Inches w.g.	% Increase
Clean Filters	1.1	--	1.0	--	3.3	--
11-30-49	4.0	264	2.2	120	7.7	133
12-31-49	3.0	-25	2.5	12	6.8	-12

Pressure losses reflect the change of all the AAF filters (glass wool) in No. 2 Cell on December 19, 1949. The replacement pockets were loaded with a layer of FG #25 backed up with a layer of FG #50 instead of the previous loading of two layers of FG #50. Experimental data indicate that the use of such a loading will give much longer filter life and is considerably less expensive than two layers of FG #50. A similar filter change was made on No. 4 Cell on April 25, 1949.

Since the Filter House was put in service November 14, 1948, it has been necessary to replace only one half of the glass wool medium due to high pressure losses. A few CWS #6 frames were removed for experimental reasons, but no change has been necessary due to pressure losses. The replacement of filters has fortunately been much less than was originally expected.

III. Filter House: - (Continued)

The build-up of radioactiviey in the Filter House has not been nearly so great as had been predicted from data collected in the Fall of 1948. A study of the activity in the Filter House was made during April, 1948, and the AAF cell found to have approximately one hundred and fifty millicuries of beta activity and sixty millicuries of gamma activity. The CWS #6 filters had caught approximately one hundred and ten millicuries of beta and gamma activity.

Since all slugs rupturing recently have been removed before any large amount of oxidation and the radiation meters in the filter cells have shown no appreciable increase in activity, it is highly improbable that the entire Filter House contains over a curie of activity.

Operation of the Filter House has been satisfactory during the year. The removal scheme for the glass wool filters is very satisfactory; however, the removal and replacement of CWS #6 filters is unreasonably difficult due to improper design. The performance of the ionization chambers to measure total activity has not been entirely satisfactory.

The Filter House has been evaluated as the removal of particulate activity and it is indicated that the only particulate activity found after filtration was due to decay of certain radioactive fission gases to solid radioactive particles.

IV. Fan Operation:

The fans operated without any difficulty during the month.

There were seven bearing failures on the two fans during 1947, four in 1948, and three in 1949. Even though the bearing performance is improving and the changing of bearings is much less difficult

IV. Fan Operation: - (Continued)

since the new Filter House prevents any appreciable build-up of radioactivity in the fans, the fans are scheduled for replacement during the coming year. The new fans will be slightly higher in capacity, equipped with sleeve bearings instead of ball bearings, and driven with the existing motors. This replacement is to be made due to frequent bearing failures. Also, it has been considered necessary to have an Operator in the Fan House at all times, since the No. 2 Fan failure on August 8, 1944, in which the fan was completely demolished.

V. Radioisotopes:

The following is a comparison of the radioisotope and research samples charged into the pile during the year 1949 with those handled in 1948:

	1948		1949	
	Research	Radioisotopes	Research	Radioisotopes
Stringers 13, 14, & 16	248	1,156	338	1,279
Hole 22 (Pneumatic Tube)	446	29	506	52
All Other Holes	132	160	180	215
TOTAL BY GROUPS	826	1,345	1,024	1,546
TOTAL FOR YEAR	2,171		2,570	

At the end of December, 1949, there were 372 cans of target material in Stringers 13, 14, and 16, compared to 353 cans of target material in these stringers at the end of November, 1949.

B. CHEMICAL SEPARATIONS AND ISOTOPE DEVELOPMENT DEPARTMENTS

I. Radioisotopes:

1. Iodine (I^{131} - 8d)

Ten ORNL slugs were processed and 18,428 millicuries shipped. The equipment was shut down during the first two weeks of the month because of the large amount of product left from the last run made from Hanford slugs.

Slightly higher than normal air counts were experienced during certain transfer operations during the month. It appears that this is caused by small leaks in the lines which are not serious enough to justify decontamination of the cells. This condition will be corrected when the tie-in is made to the new exhaust stack.

Summary of Operation for the Year 1949

Practically all I^{131} produced in 1949 came from the fission iodine process. Only eight cans of tellurium were processed in January.

The equipment operated well during most of the year. The cell was decontaminated once to replace ionization chambers and to repair leaks in UNH transfer lines and sample line.

Hanford-irradiated slugs were successfully used in three runs. In each case, a sufficient amount of I^{131} was produced from two slugs to satisfy demands for a three-week period. The two-week period following the run was used for either repairs to equipment or processing of other isotopes.

Additional shielding was installed in Room 10 to decrease the background in that operating area early in the year. After the first Hanford-slug run, it was also necessary to add lead shielding between Rooms 10 and 11 in order to reduce the background in Room 11.

I. Radioisotopes: - (Continued)

2. Phosphorus (P^{32} - 14.3d)

Twenty 2,000-gram cans of irradiated sulfur were processed and 6,009 millicuries shipped.

All extractions but one yielded 800 to 900 millicuries per can. The one exception gave 600 millicuries. The reason for the low yield is not known.

Final purification yields, based on amounts of P^{32} extracted from the sulfur, ranged between 59% and 74%. A large percentage of the glassware (final purification) losses are due to product adsorbing on the equipment.

Summary of Operation for the Year 1949

It was hoped at one time that the equipment located in Cell V would be capable of producing enough P^{32} to meet requirements until new permanent equipment was set up in the 900 Area. After many equipment failures, however, it became apparent by September that temporary equipment had to be set up before the 900 Area equipment could be put into operation.

Two temporary extractors were fabricated and installed on the east side of the ruthenium equipment at the Tank Farm, and the product purification glassware was installed in Building 204. The work was done on an emergency basis and production in the new equipment was begun in October.

Although the temporary equipment still leaves much to be desired, it has operated well enough to produce an adequate amount of product to satisfy all demands.

I. Radioisotopes: - (Continued)

2. Phosphorus Development Work

Fabrication of parts for the sulfur extraction equipment is approximately 10% completed. Further progress is contingent upon the arrival of special valves and other purchased parts.

During the month it was decided to revise the present containers used for irradiation of sulfur in the X-pile. The main feature in the new designs under investigation is provision of greater clearance in the graphite channel to permit greater flow of cooling air and allow contact with the graphite only through two thin ribs; these measures will allow the sulfur to remain much cooler, below the melting point. It is advantageous to maintain the sulfur below the melting point to allow the can to be completely filled, minimize gas pressure and sulfur leakage, and reduce corrosion of the aluminum can. The opening in the end of the can for loading and unloading sulfur is being enlarged to facilitate these operations. The general construction of the can is being revised to permit easier and cheaper fabrication.

Nine sulfur slugs irradiated at Hanford, containing approximately 100 grams each, were received and processed. The yield, calculated to the time of discharge at Hanford, was 7,100 millicuries or 71 millicuries per gram. However, approximately twenty-seven days intervened between discharge and shipment of product solutions, so that only 1,900 millicuries were finally obtained. Experience in shipping and handling this material will improve the overall yield and this new source will provide an important addition to our supply of P^{32}.

I. Radioisotopes: - (Continued)

2. Phosphorus Development Work

Approximately fifty millicuries of carrier-free P^{32} were produced from wastes during the month.

3. Carbon (C^{14} - 5720y)

Four runs, using one hundred cans of $Ca(NO_3)_2$ each, were made to yield a total of 313 millicuries with an average isotopic ratio of 7.35%. One run was made with an isotopic ratio of 9.0%, which is an all-time record for the calcium nitrate process.

Summary of Operations for the Year 1949

A total of 2,980 cans of calcium nitrate slugs was processed to yield 3,402 millicuries of C^{14} with an average isotopic ratio of 5.39%. The equipment operated with only minor difficulties during the entire year.

At the end of the year a total of 4,030 cans of calcium nitrate remained in the pile. These will be processed as fast as can be practically scheduled so that the equipment in Cell V can be removed to make room for other purposes. It is expected that by the time these cans are used up, the beryllium-nitride processing equipment will be in operation in the 900 Area.

Carbon (C^{14}-5100y) Be_3N_2 Process - Development Work

Design work on the Be_3N_2-C^{14} installation in Building 905 is approximately 50% completed.

I. Radioisotopes: - (Continued)

4. Sulfur (S^{35} - 87.1d)

A Hanford-irradiated unit of NaCl was processed to produce 5,250 millicuries of carrier-free sulfate. Analysis of this batch is as follows:

Concentration-----	27.7 mc S^{35}/ml
Total Solids------	0.2 mg/ml
NVM---------------	0.0 mg/ml
SO_4---------------	Not detected

A large portion of this batch will be converted to elemental sulfur (with carrier) for a special order.

5. Fission Products

Run SS-20, processing old Hanford metal for long-lived fission products, was started early this month and is still in progress; end products are now being taken off. The composition of this fission product solution, calculated from starting analyses, is as follows:

Input, gross beta, 16,950 mc.

Breakdown of Various Species

Starting Solution		Estimated Recovery
Zr-Cb----------	15 mc	10 mc
Ru^{106}----------	627	400
Cs^{137}----------	1850	1500
Rare Earths----	4740	4000
Ce^{144}----------	5800	5000
Sr^{90}-----------	2000	1500
TOTAL------	15,032	12,400

All effluents from every stage on every column have been saved and analyzed to track down the distribution of Cs, Ru, Tc, and the more obscure rare earths.

I. Radioisotopes: - (Continued)

5. Fission Products

Approximately 100% of the cesium appeared in the 0.25 M H_2SO_4 uranium effluent from column No. 2. A sodium diuranate precipitation was made on the fifty-six liters of total effluent. The supernatant liquid was decented off, diluted one to five and put through 2.5 liters of Dowex 50 resin in column No. 2. The cesium was put on the column until it began to break through into the effluent. The column was then washed with water, the sodium removed with 0.1 N HCl, and Cs stripped off in 6 N HCl.

The UNH effluent from column No. 2 was treated with platinum sulfide to precipitate ruthenium and technetium. The precipitate was filtered out in a Stang reactor and dissolved in ammonia-hydrogen peroxide mixture; ruthenium was distilled from this solution in the regular production apparatus, using $KMnO_4$-H_2SO_4 oxidizing agent. Only about one half of the ruthenium was carried from the solution with platinum sulfide; lead sulfide scavenger will be used in future precipitations to increase the efficiency of this step. A portion of the ruthenium effluent will be made alkaline and passed through an anion exchange column to check the efficiency of removal of ruthenium as the ruthenate by this medium. However, it is anticipated that the anion resin will be damaged by radiation if any considerable amount of ruthenium is taken up.

I. Radioisotopes: - (Continued)

5. Fission Products

The column No. 1 product, Zr-Cb, showed little activity, as expected. There should be much inactive zirconium in this fraction which may be of scientific interest, so this sample was stored for future reference.

The rare earth group, which should contain appreciable amounts of Pm, Eu, Sm, was separated and will be further fractionated by ion exchange and an electrolytic reduction and co-precipitation method which takes advantage of the fact that europium, unlike most rare earths, may be reduced to a lower valence state and co-precipitated with strontium sulfate.

Dowex 50 (Nalcite HCR) was used in the main separations column No. 2 for the first time. The total volume of resin used was 1.25 liters. For this particular application Dowex 50 resin was found to be inferior in almost every respect when compared with Amberlite resin. The charge was put on the column three times slower than with Amberlite; uranium removal required 25% more sulfuric acid and was slower by a factor of six. Stripping the fission products with 10% HNO_3 was no slower than with Amberlite, but there was a great deal of "color throw". The concentrate (in the evaporator) of the 10% HNO_3 stripping solution was a dark green viscous liquid which was finally cleared up after prolonged oxidation with boiling aqua regia.

I. Radioisotopes: - (Continued)

5. Fission Products

Ninety percent of the operating manual write-up has been completed and two Chemical Separations Department operators are in training.

a. Columbium (Cb^{95} - 35d)

A special order has been received in which the user desires to have Cb^{95} in citric rather than oxalic acid. The Cb was carried on MnO_2 as usual and then dissolved in 0.2 M citric acid. The solution was passed through a Dowex 50 column to remove the Mn^{+++} and the Cb passed through into the effluent. However, since citric acid complexes Cb to a lesser degree than oxalic acid, the losses on the resin were considerably higher than in the normal procedure.

b. Strontium (Sr^{90} - 25y)

Equipment for purification of Sr^{90} by either of two processes is installed in Building 907 and will be started up when the ventilation system for the 900 Area is put into operation.

c. Cesium (Cs^{137} - 33y)

Four batches of cesium were processed during the month and approximately 2,000 millicuries of Cs^{137} were produced. All outstanding orders were filled.

d. Barium (Ba^{140} - 12.8d)

A special order was received to prepare Ba^{140}, containing inactive Ba carrier, but essentially free from Sr, active or inactive. Preliminary experiments

I. Radioisotopes: - (Continued)

5. Fission Products

d. Barium (Ba^{140} - 12.8d)

were made to show that Ba^{140} could be produced to contain less than 0.01% Sr.

6. Tritium (H^3 - 12.1y)

A system for the purification, assaying, storage, and packaging of tritium has been designed. All necessary parts have either been fabricated or are on order. An electrometer has been completed for use in measuring ion chamber currents for the assay of tritium.

The hood to enclose the equipment is now being fabricated in the shops and should be completed by February 1, 1950.

The containers for shipping radioactive gases have been designed, following the Argonne design in most details. Two sizes of bulbs are planned at present, 10 ml and 25 ml.

7. Ruthenium (Ru^{106} - 1y)

Approximately 200 millicuries of high specific activity Ru^{106} (10 mc/mg Ru) was produced from the SS #20 platinum sulfide precipitate. This material will be used for the 125-millicurie small source which has been held up pending the preparation of high specific activity Ru^{106}.

8. Iron (Fe^{55-59} - 4y, 44d)

A Hanford-irradiated sample of normal iron was processed. Since some of the iron powder was needed for a special order, the ampoule was opened in air. It was observed that there was considerable gas pressure within the ampoule; this had not been observed before, because the ampoule is ordinarily

I. Radioisotopes: - (Continued)

8. Iron (Fe^{55-59} - 4y, 44d)

opened under water. The brilliant blue-green flash of light that always accompanies the rupture of these irradiated ampoules occurred as usual. The remainder of the iron was processed into ferric chloride solution to be assayed and dispensed.

9. Calcium (Ca^{45} - 180d)

A sample of Ca^{44} (enriched material from Y-12) was irradiated at Hanford for approximately one year. This material was processed and prepared as a solution of $CaCl_2$ with the following analysis:

Total Ca^{45}----------183 mc
Concentration-------1.46 mc/ml
Specific Activity---1.83 mc/mg Ca
Acidity-------------0.067 N

A batch of low specific activity material was prepared from $Ca(NO_3)_2$ waste from the C^{14} process. Analysis of $CaCl_2$ solution:

Total Ca^{45}----------29 mc
Concentration-------0.058 mc/ml
Specific Activity---0.00057 mc/mg Ca
Acidity-------------0.115 N

10. Cyclotron Targets

Two Na^{22}, one Co^{57}, and one Be^7 target are being processed. The Fe^{59} target has not yet been received. One test target for I^{125} was processed and the yield tentatively found to be much lower than anticipated. It is believed that the original information received on the amount of I^{125} formed per beam hour of bombardment is in error.

I. Radioisotopes: - (Continued)

10. Cyclotron Targets

Following is a table showing the bombardments received, the bombardments in production but not received, the total number of cyclotron hours outstanding on the purchase order to each institution, and the shipments of processed cyclotron isotopes:

	M.I.T.	Calif.	Pittsburgh	St. Louis
Bombardments Received:				
Na^{22}	----------	----------	5 bombardments (201.75 hrs.)	3 bombardments (200 hours)
Be^{7}	----------	----------	3 bombardments (60 hours)	----------
I^{125}	----------	----------	----------	1 bombardment (10 hours)
Co^{57}	----------	----------	----------	2 bombardments (50 hours)
Bombardments Requested but not Received:				
Na^{22}	----------	----------	----------	1 bombardment (100 hours)
As^{73}	----------	----------	1 bombardment (10 hours)	----------
Mn^{52}	----------	----------	1 bombardment (10 hours)	----------
Zn^{65}	1 bombardment (100 hours)	1 bombardment (40 hours)	----------	----------
Fe^{59}	----------	2 bombardments (90 hours)	----------	----------
Total Number of Cyclotron Hours Outstanding:	750	750	488.25	490

Shipments of Cyclotron Processed Isotopes:

Na^{22} (4 Shipments - .9 mc)

Be^{7} (1 Shipment - .673 mc)

~~SECRET~~

I. Radioisotopes: - (Continued)

10. Cyclotron Targets

The delay in the completion of the Radioisotope Area is preventing production of a number of cyclotron targets. Outstanding orders are on hand for the following cyclotron isotopes: Be^{7}, Na^{22}, I^{125}, Zn^{65}, and Fe^{59}.

11. Miscellaneous

a. Thallium (Tl^{204} - 2.7y)

A Hanford-irradiated unit was processed to produce thallium nitrate solution for dispensing. The analysis is not completed.

b. Titanium (Ti^{51} - 72d)

TiO_2 irradiated in the X-pile was purified and prepared as $TiCl_3$ solution for dispensing. Analysis is given below.

Concentration------0.00026 mg/ml
Specific Activity--5.3×10^{-5} mc/mg Ti

II. Tank Farm and Burial Ground:

1. General

Approximately 91,200 gallons of precipitated metal supernate were jetted from W-7 tank to the Chemical Waste System. This contained an average of .012% uranium. As soon as this transfer was made, 85,200 gallons of metal waste from W-9 and W-4 were jetted to W-7 tank and 4,900 gallons of 50% caustic were added to precipitate the uranium. This slurry is now settling prior to decantation.

II. Tank Farm and Burial Ground: - (Continued)

2. Wastes Discharged to the White Oak Creek

As indicated in the table below, approximately 7.97 curies of beta activity were discharged from the Settling Basin this month. This was the lowest discharge of activity for any similar period in the last several years.

Discharged From	Gallons	Curies
Settling Basin	19,562,000	7.97
Retention Pond	494,500	1.05

3. Chemical Waste Evaporator

The operation of the evaporator was continued as was outlined in last month's report. Due to high specific gravity feed solution during most of the month, poor volume reductions were obtained.

The evaporator was shut down for a few hours of one day for the installation of an anti-foam feed line. The pump to this line has not yet been connected.

4. Waste Tank Inventory

Tanks	Gallons Capacity	Gallons In	Gallons Out	Discharged to	Free Space
		HOT PILOT PLANT STORAGE			
W-3	41,300	0	0	--	5,624
		CHEMICAL WASTE STORAGE			
W-5	170,000	243,414	247,014	Evaporator	45,600
		EVAPORATOR CONCENTRATE STORAGE			
W-6	170,000	26,400	49,200	W-8	88,800
W-8	170,000	58,800	0	--	40,800
		METAL WASTE STORAGE			
W-4,7,9,10	543,000	5,080	40,800	Evaporator	91,760

II. Tank Farm and Burial Ground: - (Continued)

5. Special Wastes

a. Six shipments from Dayton were buried.

b. Two shipments from K-25, one from Y-12, and one from NEPA were buried.

c. Eleven drums and eight pots of uranium-plutonium waste and one pot of chemical waste were received from Chicago this month.

d. A total of 262,534 grams of uranium was received in the Metal Waste System this month. Of this, the Operations Division, Chemical Separations, transferred 48,972 grams and the Technical Division, Section I, transferred 213,562 grams.

6. Summary of Operation for the Year 1949

The year's highlight in the operation of the waste disposal system was the addition of the chemical waste evaporator in June. The problem of radioactive waste disposal became progressively greater in 1948 so that by January it was practically impossible to dispose of all laboratory wastes by discharging them to the White Oak Creek after storage and decay at the Tank Farm. Before the evaporator was put into operation, the storage problem became so acute that it became necessary to store some of the active wastes in an open pond.

The situation improved immediately after the evaporator was put in operation and it continued to steadily improve so that in the month of December, less than eight curies were discharged from the Settling Basin to the Creek as compared to a monthly average of 140 curies for the first five months of year before the evaporator was put into operation.

II. Tank Farm and Burial Ground: - (Continued)

6. Summary of Operation for the Year 1949

Future operation of the evaporator is expected to further decrease the output of activity into the Creek. To date it has been impossible to operate the evaporator under optimum conditions because of the tremendous backlog of waste built up before the evaporator was put into operation. It has been necessary to operate it far above its design capacity in order to keep up with current wastes and to process the backlog. To further aggravate the situation, this large backlog of wastes consisted of caustic supernatant from the metal waste tanks which is extremely difficult to process because of its foaming characteristics.

As previously mentioned, the discharge of activity from the Settling Basin to the Creek, during the first five months of the year, prior to the installation of the evaporator, averaged 140 curies per month and varied between 108 and 155 curies. The following table shows the monthly discharge of activity since the installation of the evaporator and some corresponding data on the evaporator operation:

Month	Beta Curies From Settling Basin To Creek	Gallons Fed To Evaporator	Beta Curies To Evaporator	Beta Curies From Evaporator to Settling Basin
June	63.5	130,466	*	*
July	50.4	231,059	*	*
August	98.4	213,242	730.3	38.5
September	61.7	258,170	935.6	12.0
October	32.0	245,140	718.0	20.9
November	16.2	285,143	1,851.3	7.8
December	8.0	247,014	578.1	2.1
TOTAL	216.3	1,248,709	4,813.3	81.3

* Accurate records for the first two months of evaporator operation are not available. The data for this period is not included in the totals.

II. Tank Farm and Burial Ground: - (Continued)

6. Summary of Operation for the Year 1949

In comparing the second and fifth column, it is interesting to note that the activity dischared from the Settling Basin to the Creek is much greater than the activity discharged from the evaporator to the Settling Basin. This indicates that the bulk of the activity now entering the Creek comes not from the "hot" lines which are tied into the evaporator but from the large-volume wastes which are discharged directly into the Settling Basin by the process waste lines. The need for a better separation of "hot" and "cold" wastes entering the process waste lines, which is planned for in the alterations under Plan "H", is quite evident.

III. RaLa (Ba^{140} - 12.5d):

After the successful completion of the experimental resin column run in which the wastes from the last RaLa run were used, an attempt was made to arrange for processing of the next complete batch, scheduled for Los Alamos, through the same resin column. Upon checking with Los Alamos, however, it was found that it was extremely important to Los Alamos that the next run be shipped on schedule and that it would not be practical to risk a late shipment because of this experimental work.

Arrangements are now being made to make a complete run solely for experimental purposes so that it will not possibly interfere with schedules at Los Alamos.

The dissolver and vessel off-gas lines were rerouted to permit excavation for the Physics of Solids Building construction.

The equipment was readied for the next run which is scheduled to start on January 1, 1950.

Summary of Operation for the Year 1949

During the year, a total of 28,073 curies of product was shipped in nine batches. This was the greatest quantity shipped in any one year. The following table shows a comparison of significant production figures for the years 1948 and 1949:

	1948	1949
Number of Shipments	6	9
Curies Shipped	13,896	28,073
Chemical Yield	68%	60.5%
Pounds of Uranium Used	11,619	3,863

The great decrease in the amount of uranium used is due to the change from using ORNL-irradiated slugs to Hanford slugs. This change was made in December, 1948, but the first completely

III. RaLa (Ba^{140} - 12.5d): - (Continued)

successful run using Hanford material was not made until April, 1949.

The yields shown do not include decay losses; all analytical data was based on the last separation time. The processing time for each run was approximately ten days in 1948, as compared to five days in 1949. This saving in processing time, due almost entirely to the change to using Hanford slugs, saved approximately 24% of the starting product in each run even though this saving does not appear in the yield figures.

The higher chemical yield in 1948, when ORNL slugs were used, was also a result of reprocessing many of the wastes when an insufficient amount of product appeared imminent during the course of the run. Although much of the starting product was lost in decay and shipments were frequently delayed as a result of reprocessing, these facts do not appear in this comparison. Since Hanford slugs were put into use, there was usually sufficient product left in spite of some high losses so that it was seldom necessary to reprocess the wastes or to delay shipments. This policy has been proven more satisfactory to Los Alamos. It has also been more advantageous to us since it involves less equipment wear, fewer repairs, fewer samples, and, as a result, less exposure of personnel to radiation.

Only one major cell decontamination (not including several cubicle decontaminations) was required during the year 1949, as compared to two decontaminations during the year 1948. This is the best record of any year, though it is still undesirable from the standpoint of exposure of personnel and could be eliminated if better equipment were available.

C. ISOTOPE CONTROL DEPARTMENT

I. General:

During December, 1949, there were 430 radioisotope shipments, compared with 542 during November. The decrease was largely due to the seasonal drop during the holiday season.

In 1948 there were 3,543 radioisotope shipments, compared with 5,597 in 1949. This is an increase of over 50%. Over twice as much material was shipped in 1949 in terms of millicuries. Furthermore, the rate at which shipments were being made at the end of 1949 in terms of millicuries represented an increase of about three times over 1948. This indicates a marked increase in the average size of shipments.

The anticipated decrease of foreign sales for 1950 is clearly shown in the table below, where only 320 shipments were made in 1949, compared with 332 in 1948.

It is also interesting to note that the percentage increase in project shipments was just slightly less than that for domestic shipments.

The breakdown of shipments according to separated and unseparated material is as follows:

	NOVEMBER 1949	DECEMBER 1949	TOTAL August, 1946, to December, 1949, Inc.
Separated Material 706-D Area	441	361	8,769
Unseparated Material 100 Area	101	69	2,583
	542	430	11,352

I. General: - (Continued)

The breakdown of shipments according to non-project, project, and foreign shipments is as follows:

	NOVEMBER 1949	DECEMBER 1949	TOTAL SHIPMENTS 1948	TOTAL SHIPMENTS 1949	% INCREASE
Non-Project	404	325	2,633	4,334	+64%
Project	118	88	578	943	+63%
Foreign	20	17	332	320	-0.5%
TOTALS	542	430	3,543	5,597	+57%

II. Cobalt 60:

Nineteen hundred forty-nine has seen the development of Cobalt 60 sources to a point where they have become very popular and where medical institutions are ready to order very large quantities in the order of 100 to 1,000 curies. Production, however, has been seriously hampered due to the restrictions by the Atomic Energy Commission on Hanford irradiations so that at the present time, we have only 1,700 curies on hand. Of this, about 1,600 curies have either been allocated or already ordered. Furthermore, the prospects for additional production are such that none will be available until the end of 1950. Therefore, it appears that there will be a considerable shortage of this isotope during 1950.

Due to the much higher flux in the Canadian Chalk River pile, Cobalt 60 with a specific activity of eight times that available in the United States is being made and sold by Canada. Since the highest specific activity available in the United States is about one curie per gram, higher specific activity material will have to be obtained from Canada.

II. Cobalt 60: - (Continued)

Four slugs irradiated at Hanford for approximately seven months were received in December, 1949, and several samples checked for specific activity. This was found to vary from 0.9 to 1.1 curies per gram.

III. Hanford Irradiations:

The Atomic Energy Commission has finally granted an increase in the allocation of inhours at Hanford for isotope irradiations. It is understood that ninety inhours will be available during December and January, and one hundred inhours will be available thereafter. This will be used mainly for the irradiation of beryllium nitride and cobalt. Due to the demand for Cobalt 60, it may be necessary to request a further allocation of inhours for the production of this isotope.

IV. Activation Analyses:

Activation analyses, being investigated by personnel in the Chemistry Division, have been requested as follows:

1. Carbide and Carbon Chemicals Division, Union Carbide and Carbon Corporation, South Charleston, West Virginia.

   Six samples of vinylite from South Charleston were forwarded for activation analyses for iron and other trace elements.

   This material has been activated but it has been found necessary to ash the samples prior to activation.

   A second set of six samples have been sent from South Charleston, December 20, 1949, for analyses for cadmium and other trace analyses.

IV. Activation Analyses: - (Continued)

2. California Research Corporation.

Three samples of bentonite were delivered to ORNL, December 2, 1949, for determination of the long-lived activities which will be present after activation. It is desired to determine whether it will be feasible to make radiographs of core drillings which have been impregnated with bentonite mud. Bentonite has considerable application in oil fields where it is used to carry away the drilling chips.

Samples of bentonite have been irradiated and the large amount of sodium activity is being allowed to decay before the long-lived activities are studied.

3. Dow Chemical Company.

Three samples of magnesium were submitted to ORNL, December 22, 1949, to determine trace impurities especially of non-metallic materials and alkali metals.

V. Outstanding Orders:

The major portion of the outstanding orders now on hand are for cyclotron isotopes, carrier-free Calcium 45, Fe^{59} prepared from enriched Fe^{58}, and Sr^{90}. Other outstanding orders are mainly for high specific activity isotopes being produced at Hanford.

VI. Tritium and Helium 3:

Approximately 200 cc of tritium and 7 cc of Helium 3 have been received from Argonne National Laboratory to be used in the Isotope Distribution Program.

VII. High Specific Activity Isotopes:

High specific activity Fe^{59} and Ca^{45} have been very successfully prepared in the past year by irradiating Fe^{58} and Ca^{44} (enriched at Y-12) at Hanford. The specific activity of each of these isotopes is in the neighborhood of one millicurie per milligram. It appears that this method may be extended to other radioisotopes where high specific activities are important.

VIII. Radioisotope Processing Area:

In the Isotope Processing Area tests were made of the operation of the exhaust blowers, motors, and the steam turbine; after adjustment of the sheaves of the 60,000 c.f.m. blower, indications are that all are satisfactory.

ORNL personnel completed installation and adjustment of most of the remote control isotope packaging equipment. Packing is scheduled to start about January 15, 1950. Installation of the equipment in the Decontamination Building was completed and operation started.

Logan B. Emlet

Logan B. Emlet, Director
Operations Division

wp

IX. S-F Material Control:

1. Eleven fuel assemblies for the MTR Project have been received and are being stored by the S-F Accountability Office until the Technical Division is ready to use them. The Analytical Laboratory, which performed the analyses of this material, is currently transferring all wastes and unused portions of samples to the Accountability Office for disposal. At this writing, one shipment of this type of material has already been sent to Y-12 for recovery.

2. In addition to the storage of the fuel assemblies for the MTR, the Accountability Office is also providing storage for the product of the U^{235} recovery process which was recently completed by the Hot Pilot Plant of the Technical Division. At the present time, we have received all of the material from the Pilot Plant Group and have since sent approximately one half of it to the Semi-Works Group for decontamination. One-third of this amount has been decontaminated and is being stored by the Accountability Office awaiting transfer to the Y-12 Area for future work at that site.

3. A clean-up campaign of the Accountability Office's storage vault facilities was inaugurated during the month, and, as a result, large amounts of enriched and normal uranium of various sizes and compounds were forwarded to Y-12 for recovery.

4. In connection with the clean-up program mentioned in the foregoing paragraph, a letter was written to the Atomic Energy Commission on December 27, 1949, advising them that we have approximately 625 pounds of both contaminated and non-contaminated

IX. S-F Material Control: - (Continued)

4. beryllium scrap which we would like to return to AEC production channels. This letter requested that they advise us as to what course of action should be followed in making disposition. It is expected that a reply will be forthcoming at an early date.

5. One car was received from Hanford containing miscellaneous orders of special materials, as well as S-F materials. Also received on this car were the "Monster" containers which will be used between the Laboratory and the Canadian Project for work which the Laboratory plans to do for Chalk River in the ensuing months.

6. On December 15, 1949, two analytical laboratories were visited for the purpose of auditing analytical data records which cover samples of S-F materials consisting of less than 50 mgs. concentration per sample.

The procedure for maintaining analytical data records was established in September, 1949, to provide for the transfer of S-F material samples for analysis purposes in lieu of the use of an Intra-Plant Transfer. In addition, the procedure requires the analytical laboratory to reflect the disposition of each sample analyzed.

The procedure functions as follows: When an S-F sample is submitted for analysis, it must be accompanied with a form entitled "Request for Analysis". This form indicates the analysis desired, type of material, any historical data peculiar to the sample, and the S-F concentration. The laboratory in turn performs the requested work, records the

IX. S-F Material Control: - (Continued).

6. results on a pre-numbered control form, indicates the sample disposition, and cross-indexes the "Request for Analysis" form with the pre-numbered control form number.

In auditing these records, it was found that the procedure was being followed with extreme care. All records checked were in very good order, and disposition of samples was given in all cases. Such terms as: "sample returned to sender","sample stored in safe", or "highly diluted, sample disposed of in chemical waste system", were employed in designating sample disposition. The pre-numbered control forms charged to the laboratories were verified and accounted for.

7. Following is a summary of receipts and shipments of S-F materials for the month of December, 1949:

RECEIPTS

FROM	MATERIAL	CONTENT
Argonne National Lab.	Waste Solution (depleted)	62.00 gm. .13 gm. Pu
" " "	II BP Blends (depleted)	39,193.00 mg. Pu
" " "	Waste Solution (depleted)	460.00 kg. 284.70 mg. Pu
" " "	Waste Solution (depleted)	60,744.00 gm. 410.52 mg. Pu
C&CCC, K-25 Area	Hanford Waste (depleted)	2,735.00 gm.
" " "	Normal Uranium	3,059.00 gm.
" " "	Hanford Waste Scrap (radioactive glass and paper)	25.00 gm.
C&CCC, Y-12 Area	Nitrate (normal)	75,784.20 gm.
" " "	Uranyl Nitrate (normal)	91,724.30 gm.
" " "	Nickel-Plated Uranium Slugs(normal)	2,332.00 gm.

IX. S-F Material Control: - (Continued)

7.

SHIPMENTS

TO	MATERIAL	CONTENT
Argonne National Lab.	Hot X Slugs (depleted)	41,976.00 gm. .67 gm. Pu
C&CCC, K-25 Area	UF_6 (depleted)	71.20 gm. .0015 gm.Pu
C&CCC, Y-12 Area	Normal Uranium Scrap	1,606,459.00 gm.
" " "	X Size Slugs	4,664.00 gm.
" " "	Normal Uranium	6,996.00 gm.
" " "	Enriched Uranium in Sulfuric Acid and Ferric Ammonia Sulfate Waste from Samples and Used Portions of Samples (94.3%)	19.62 gm.
" " "	Enriched Uranium (4 to 6.5%) Rags, Oil, Paper, and Scrap Metal	234.071 gm.
" " "	92.9% Enriched Uranium-Beryllium Alloy in 150 ml. Solution	.45 gm.
" " "	Enriched Uranium (38.0%)	145.37 gm.
" " "	Enriched Uranium (93.0 to 95%)	98.10 gm.
Naval Research Lab.	Approximately 1 ml. of a 1 to 2 N.HNO_3 Solution of Pu, Containing Approximately 4000 d/m Pu.	4,000.00 d/m
" " "	Thorium Metal	.605 gm.
Knolls Atomic Power Lab.	9 Pieces Cut from X Slugs (depleted)	300.00 gm. .04 gm. Pu
" " " "	Hot X Slugs (depleted)	275,176.00 gm. 4.63 gm. Pu
Mallinckrodt Chem. Co.	Decontaminated Redox Uranium UNH Solution	231,693.77 gm.